iaf

Institut für angewandte Forschung

Abschlussbericht zum Projekt:

Entwicklung eines energiesparenden Verfahrens zum Hochenergiewasserstrahlen

gefördert von der Deutschen Bundesstiftung Umwelt unter dem Az: 23757

Band II – Anhang

Verfasser:
Pradeep Narrain, Institut für Angewandte Forschung, Hochschule Esslingen, 73728 Esslingen
Prof. Dr.-Ing. Ulrich Gärtner, Institut für Angewandte Forschung, Hochschule Esslingen, 73728 Esslingen
Thomas Piller, Piller Entgrattechnik GmbH, 71254 Ditzingen

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INHALTSVERZEICHNIS

1 Anhang

1.1 ICEMCFD Skript

```
ic_geo_new_family POINTS
ic_undo_group_begin
ic_geo_cre_pnt POINTS {} {0 0 0}
ic_geo_cre_pnt POINTS {} {17 0 0}
ic_geo_cre_pnt POINTS {} {17 -17 0}
ic_geo_cre_pnt POINTS {} {34 -17 0}
ic_geo_cre_pnt POINTS {} {34 0 0}
ic_geo_cre_pnt POINTS {} {51 0 0}
ic_geo_cre_pnt POINTS {} {0 17 0}
ic_geo_cre_pnt POINTS {} {17 17 0}
ic_geo_cre_pnt POINTS {} {17 34 0}
ic_geo_cre_pnt POINTS {} {34 34 0}
ic_geo_cre_pnt POINTS {} {34 17 0}
ic_geo_cre_pnt POINTS {} {51 17 0}
ic_geo_cre_pnt POINTS {} {51 -13 0}
ic_geo_cre_pnt POINTS {} {64 -13 0}
ic_geo_cre_pnt POINTS {} {64 -26 0}
ic_geo_cre_pnt POINTS {} {64 0 0}
ic_geo_cre_pnt POINTS {} {51 30 0}
ic_geo_cre_pnt POINTS {} {64 30 0}
ic_geo_cre_pnt POINTS {} {64 43 0}
ic_geo_cre_pnt POINTS {} {64 17 0}
ic_geo_cre_pnt POINTS {} {102 0 0}
ic_geo_cre_pnt POINTS {} {-50 -29 0}
ic_geo_cre_pnt POINTS {} {-60 -29 0}
ic_geo_cre_pnt POINTS {} {102 17 0}
ic_geo_cre_pnt POINTS {} {-50 46 0}
ic_geo_cre_pnt POINTS {} {-60 46 0}
ic_geo_new_family CURVES
ic_curve point POINTS crv.00 {POINTS.22 POINTS.21}
ic_curve point POINTS crv.01 {POINTS.21 POINTS}
ic_curve point POINTS crv.02 {POINTS POINTS.1}
ic_curve point POINTS crv.03 {POINTS.1 POINTS.2}
ic_curve point POINTS crv.04 {POINTS.2 POINTS.3}
ic_curve point POINTS crv.05 {POINTS.3 POINTS.4}
ic_curve point POINTS crv.06 {POINTS.4 POINTS.5}
ic_curve point POINTS crv.07 {POINTS.5 POINTS.12}
ic_curve point POINTS crv.08 {POINTS.15 POINTS.20}
ic_curve point POINTS crv.09 {POINTS.20 POINTS.23}
ic_curve point POINTS crv.10 {POINTS.23 POINTS.19}
ic_curve point POINTS crv.11 {POINTS.16 POINTS.11}
ic_curve point POINTS crv.12 {POINTS.11 POINTS.10}
ic_curve point POINTS crv.13 {POINTS.10 POINTS.9}
ic_curve point POINTS crv.14 {POINTS.9 POINTS.8}
ic_curve point POINTS crv.15 {POINTS.8 POINTS.7}
ic_curve point POINTS crv.16 {POINTS.7 POINTS.6}
ic_curve point POINTS crv.17 {POINTS.6 POINTS.24}
ic_curve point POINTS crv.18 {POINTS.24 POINTS.25}
ic_curve point POINTS crv.19 {POINTS.25 POINTS.22}
ic_curve arc POINTS crv.20 {POINTS.16 POINTS.18 POINTS.19}
ic_curve arc POINTS crv.21 {POINTS.15 POINTS.14 POINTS.12}
```

```
ic_curve arc GEOM crv.22 {}
ic_geo_set_part curve crv.19 IN 0
ic_geo_set_part curve crv.09 OUT 0
ic_geo_set_part curve {crv.18 crv.17 crv.16 crv.15 crv.14 crv.13 crv.12 crv.11 crv.20 crv.10}
WAND1 0
ic_geo_set_part curve {crv.00 crv.01 crv.02 crv.03 crv.04 crv.05 crv.06 crv.07 crv.21 crv.08}
WAND2 0
ic_undo_group_end
ic_save_tetin ./ICEMCFD.tin 0
ic_load_tetin ./ICEMCFD.tin
ic_undo_group_begin
ic_geo_new_family SEITE1
ic_boco_set_part_color SEITE1
ic_hex_initialize_mesh 2d new_numbering new_blocking SEITE1
ic_hex_switch_blocking root
ic_hex_unblank_blocks
ic_hex_multi_grid_level
ic_hex_compute_mesh_size POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_switch_blocking root
ic_hex_split_grid 11 19 0.492473 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 33 19 0.514599 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 37 19 0.185201 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 41 19 0.172446 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 45 19 0.2652 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 49 19 0.476898 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 19 21 0.441892 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_hex_split_grid 64 21 0.213171 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1
ic_undo_group_end
ic_undo_group_begin
ic_hex_mark_blocks unmark
ic_hex_mark_blocks superblock 24
ic_hex_mark_blocks superblock 26
ic_hex_mark_blocks superblock 28
ic_hex_mark_blocks superblock 14
ic_hex_mark_blocks superblock 12
ic_hex_mark_blocks superblock 10
ic_hex_mark_blocks superblock 22
ic_hex_mark_blocks superblock 23
ic_hex_mark_blocks superblock 9
ic_hex_mark_blocks superblock 4
ic_hex_change_element_id VORFN
ic_undo_group_end
ic_undo_group_begin
ic_hex_set_edge_projection 57 67 0 1 crv.19
ic_hex_set_edge_projection 67 68 0 1 crv.18
ic_hex_set_edge_projection 57 58 0 1 crv.00
ic_hex_set_edge_projection 68 69 0 1 crv.17
ic_hex_set_edge_projection 58 59 0 1 crv.01
ic_hex_set_edge_projection 69 70 0 1 crv.16
ic_hex_set_edge_projection 59 60 0 1 crv.02
ic_hex_set_edge_projection 41 60 0 1 crv.03
ic_hex_set_edge_projection 41 45 0 1 crv.04
ic_hex_set_edge_projection 45 61 0 1 crv.05
ic_hex_set_edge_projection 61 62 0 1 crv.06
ic_undo_group_begin
ic_hex_create_composite {crv.07 crv.21}
```

```
ic_hex_set_edge_projection 49 62 0 1 crv.07
ic_hex_set_edge_projection 49 53 0 1 crv.07
ic_hex_set_edge_projection 53 63 0 1 crv.07
ic_undo_group_end
ic_hex_set_edge_projection 63 64 0 1 crv.08
ic_hex_set_edge_projection 64 74 0 1 crv.09
ic_hex_set_edge_projection 73 74 0 1 crv.10
ic_undo_group_begin
ic_hex_create_composite {crv.20 crv.11}
ic_hex_set_edge_projection 73 54 0 1 crv.20
ic_hex_set_edge_projection 50 54 0 1 crv.20
ic_hex_set_edge_projection 72 50 0 1 crv.20
ic_undo_group_end
ic_undo_group_begin
ic_undo_group_end
ic_hex_set_edge_projection 71 72 0 1 crv.12
ic_hex_set_edge_projection 71 46 0 1 crv.13
ic_hex_set_edge_projection 42 46 0 1 crv.14
ic_hex_set_edge_projection 70 42 0 1 crv.15
ic_undo_group_end
ic_undo_group_begin
ic_hex_place_node 67 curve:crv.19 0
ic_hex_place_node 57 curve:crv.19 1
ic_hex_place_node 68 curve:crv.18 0
ic_hex_place_node 58 curve:crv.00 1
ic_hex_place_node 69 curve:crv.17 0
ic_hex_place_node 59 curve:crv.01 1
ic_hex_place_node 70 curve:crv.16 0
ic_hex_place_node 42 curve:crv.14 1
ic_hex_place_node 46 curve:crv.13 1
ic_hex_place_node 71 curve:crv.12 1
ic_hex_place_node 72 curve:crv.11 1
ic_hex_place_node 50 curve:crv.20 0.2
ic_hex_place_node 54 curve:crv.20 0.6
ic_hex_place_node 53 curve:crv.21 0.4
ic_hex_place_node 49 curve:crv.21 0.8
ic_hex_place_node 73 curve:crv.10 1
ic_hex_place_node 74 curve:crv.09 1
ic_hex_place_node 64 curve:crv.08 1
ic_hex_place_node 63 curve:crv.08 0
ic_hex_place_node 62 curve:crv.06 1
ic_hex_place_node 61 curve:crv.05 1
ic_hex_place_node 45 curve:crv.04 1
ic_hex_place_node 41 curve:crv.03 1
ic_hex_place_node 60 curve:crv.02 1
ic_undo_group_begin
ic_hex_set_mesh { 57 } 67 n 30 spline 3 0.0 1.0 0.5 0.34 1.0 1.0 unlocked
ic_hex_dem m POINTS CURVES IN OUT WAND1 WAND2 SEITE1 volume selected_bunching
highlight { 57 } 67
ic_hex_set_mesh 67 68 n 10 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 68 69 n 50 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 69 70 n 30 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 42 46 n 30 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 1e+010 default copy_to_parallel
unlocked
ic_hex_set_mesh 70 42 n 30 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 41 60 n 30 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
```

```
ic_hex_set_mesh 71 72 n 30 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 73 74 n 65 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_set_mesh 49 53 n 18 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_undo_group_end
ic_undo_group_end
ic_hex_mark_blocks unmark
ic_hex_mark_blocks superblock 27
ic_hex_mark_blocks superblock 13
ic_hex_ogrid 1 m POINTS CURVES IN OUT WAND1 WAND2 SEITE1 -version 50
ic_hex_mark_blocks unmark
ic_hex_set_mesh 54 83 n 12 h1rel 0.0 h2rel 0.0 r1 2 r2 2 lmax 0 default copy_to_parallel unlocked
ic_hex_create_mesh POINTS CURVES IN OUT WAND1 WAND2 SEITE1 proj 2 dim_to_mesh 3
ic_hex_write_file hex.uns POINTS CURVES IN OUT WAND1 WAND2 SEITE1 proj 2
dim_to_mesh 3 -family_boco family_boco.fbc
ic_uns_load hex.uns 3 0 {} 2
ic_uns_subset_set_current selected
ic_uns_update_family_type visible {WAND2 OUT CURVES POINTS ORFN SEITE1 WAND1 IN}
{!LINE_2 QUAD_4} update 0
ic_uns_diag_reset_degen_min_max
ic_boco_solver
ic_uns_subset_set_current selected
ic_uns_update_family_type visible {WAND2 OUT CURVES POINTS ORFN SEITE1 WAND1 IN}
{!LINE_2 QUAD_4} update 0
ic_boco_clear_icons
ic_csystem_display all 0
ic_csystem_set_current global
ic_boco_nastran_csystem reset
ic_uns_subset_set_current selected
ic_uns_update_family_type visible {WAND2 OUT CURVES POINTS ORFN SEITE1 WAND1 IN}
{LINE_2 QUAD_4} update 0
ic_uns_create_selection_subset 0
ic_uns_create_selection_edgelist 1
ic_uns_subset_configure uns_sel_0 -draw_nodes 1
ic_uns_subset_visible uns_sel_0 0
ic_uns_subset_create
ic_uns_subset_copy uns_sub_0 Selected element
ic_uns_subset_copy uns_sel_0 uns_sub_0
ic_uns_subset_add_from uns_sel_0 uns_sub_0
ic_uns_subset_delete uns_sub_0
ic_uns_uniqify uns_sel_0
ic_uns_subset_visible uns_sel_0 0
ic_uns_create_selection_edgelist 0
ic_undo_group_begin
ic_geo_new_family SEITE2
ic_boco_set_part_color SEITE2
ic_extrude map uns_sel_0 numlayers 1 dir normal space 1 space_func {} rpoint {0 0 0} rdir {0 0 0}
rangle 10.0 volf SEITE2 sidef inherited topf inherited curve {} curvedir 0 twist 0 del_orig 0
del_covered 1 degen_tol 0.00001 project 0
ic_uns_subset_delete smooth_show_map
ic_uns_diag_reset_degen_min_max
ic_uns_subset_delete uns_sel_0
ic_uns_subset_set_current selected
ic_uns_update_family_type visible {SEITE2 WAND2 OUT CURVES CREATED_FACES POINTS
ORFN SEITE1 WAND1 IN} {LINE_2 QUAD_4 !HEXA_8} update 0
ic_undo_group_end
ic_boco_solver {ANSYS CFX}
```

```
ic_boco_save ./icemcfd.cfx5.fbc
ic_boco_save ./icemcfd.fbc
ic_save_unstruct ./icemcfd.uns 1 {} {} {}
ic_exec {D:/Programme/ANSYS Inc/v110/icemcfd/win/icemcfd/output-interfaces/cfx5} -dom
icemcfd.uns -b ./icemcfd.cfx5.fbc -ascii -db -internal_faces ./icemcfd.cfx5
```

1.2 ANSYS CFX

1.2.1 IAF Water.ccl

```
# State file created:  2006/04/04 10:47:40
# CFX-10.0 build 2005.10.26-23.10

LIBRARY:
  MATERIAL:IAF Water
    Material Description = rho=f(t)
    Material Group = User
    Option = Pure Substance
    Thermodynamic State = Liquid
    PROPERTIES:
      Option = General Material
      Thermal Expansivity = 0.000257 [K^-1]
      ABSORPTION COEFFICIENT:
        Absorption Coefficient = 1.0 [m^-1]
        Option = Value
      END
      DYNAMIC VISCOSITY:
        Dynamic Viscosity = 0.0008899 [kg m^-1 s^-1]
        Option = Value
      END
      EQUATION OF STATE:
        Density = dp
        Density Depends On = Pressure
        Molar Mass = 18.02 [kg kmol^-1]
        Option = Value
      END
      REFRACTIVE INDEX:
        Option = Value
        Refractive Index = 1.0
      END
      SCATTERING COEFFICIENT:
        Option = Value
        Scattering Coefficient = 0. [m^-1]
      END
      SPECIFIC HEAT CAPACITY:
        Option = Value
        Reference Pressure = 1 [atm]
        Reference Specific Enthalpy = 0 [J kg^-1]
        Reference Specific Entropy = 0 [J kg^-1 K^-1]
        Reference Temperature = 25 [C]
        Specific Heat Capacity = 4181.7 [J kg^-1 K^-1]
        Specific Heat Type = Constant Pressure
      END
```

```
      THERMAL CONDUCTIVITY:
        Option = Value
        Thermal Conductivity = 0.6069 [W m^-1 K^-1]
      END
    END
  END
END

COMMAND FILE:
  Version = 10.0
END
```

1.2.2 presession steady

```
# Session file started:  2008/10/24 13:09:31
# CFX-11.0 build 2007.08.09-23.01

COMMAND FILE:
  CFX Pre Version = 11.0
END

>load mode=new
> update

>writeCaseFile filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/\
081024_steady.cfx
> update

>gtmImport filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/icemcfd.cfx5, \
type=Generic, genOpt= -n, units=mm, nameStrategy= Assembly
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      Bw=3.03e8 [Pa]
    END
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      rho=997.15 [kg m^-3]
    END
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      gamma=7.15
    END
```

```
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      dp=((p + Bw)/Bw)^(1/gamma)*rho
    END
  END
END
> update

# Imported library information
LIBRARY:
    MATERIAL: IAF Water
    Material Description = rho=f(t)
    Material Group = User
    Option = Pure Substance
    Thermodynamic State = Liquid
    PROPERTIES: PROPERTIES
      Option = General Material
      Thermal Expansivity = 0.000257 [K^-1]
      ABSORPTION COEFFICIENT: ABSORPTION COEFFICIENT
        Absorption Coefficient = 1.0 [m^-1]
        Option = Value
      END
      DYNAMIC VISCOSITY: DYNAMIC VISCOSITY
        Dynamic Viscosity = 0.0008899 [kg m^-1 s^-1]
        Option = Value
      END
      EQUATION OF STATE: EQUATION OF STATE
        Density = dp
        Molar Mass = 18.02 [kg kmol^-1]
        Option = Value
      END
      REFRACTIVE INDEX: REFRACTIVE INDEX
        Option = Value
        Refractive Index = 1.0
      END
      SCATTERING COEFFICIENT: SCATTERING COEFFICIENT
        Option = Value
        Scattering Coefficient = 0. [m^-1]
      END
      SPECIFIC HEAT CAPACITY: SPECIFIC HEAT CAPACITY
        Option = Value
        Specific Heat Capacity = 4181.7 [J kg^-1 K^-1]
        Specific Heat Type = Constant Pressure
      END
      THERMAL CONDUCTIVITY: THERMAL CONDUCTIVITY
        Option = Value
        Thermal Conductivity = 0.6069 [W m^-1 K^-1]
      END
      REFERENCE STATE: REFERENCE STATE
        Reference Pressure = 1 [atm]
        Reference Temperature = 25 [C]
```

```
      Reference Specific Enthalpy = 0 [J kg^-1]
      Reference Specific Entropy = 0 [J kg^-1 K^-1]
      Option = Specified Point
    END
  END
 END
END

LIBRARY:
  MATERIAL GROUP: User
  Group Description = Materials that are defined by the user
 END
END
> update

FLOW:
  SIMULATION TYPE:
  Option = Steady State
  EXTERNAL SOLVER COUPLING:
    Option = None
  END # EXTERNAL SOLVER COUPLING:
 END # SIMULATION TYPE:
END # FLOW:
> update

>writeCaseFile operation=backup
> update

FLOW:
  DOMAIN: Domain 1
  Coord Frame = Coord 0
  Domain Type = Fluid
  Fluids List = IAF Water
  Location = Assembly
  DOMAIN MODELS:
    BUOYANCY MODEL:
      Option = Non Buoyant
    END # BUOYANCY MODEL:
    DOMAIN MOTION:
      Option = Stationary
    END # DOMAIN MOTION:
    MESH DEFORMATION:
      Option = None
    END # MESH DEFORMATION:
    REFERENCE PRESSURE:
      Reference Pressure = 1e5 [Pa]
    END # REFERENCE PRESSURE:
  END # DOMAIN MODELS:
  FLUID MODELS:
    COMBUSTION MODEL:
      Option = None
    END # COMBUSTION MODEL:
    HEAT TRANSFER MODEL:
      Option = Total Energy
    END # HEAT TRANSFER MODEL:
    THERMAL RADIATION MODEL:
```

```
      Option = None
    END # THERMAL RADIATION MODEL:
    TURBULENCE MODEL:
      Option = k epsilon
    END # TURBULENCE MODEL:
    TURBULENT WALL FUNCTIONS:
      Option = Scalable
    END # TURBULENT WALL FUNCTIONS:
  END # FLUID MODELS:
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: IN
    Boundary Type = INLET
    Interface Boundary = Off
    Location = IN
    BOUNDARY CONDITIONS:
      FLOW DIRECTION:
        Option = Normal to Boundary Condition
      END # FLOW DIRECTION:
      FLOW REGIME:
        Option = Subsonic
      END # FLOW REGIME:
      HEAT TRANSFER:
        Option = Static Temperature
        Static Temperature = 298 [K]
      END # HEAT TRANSFER:
      MASS AND MOMENTUM:
        Mass Flow Rate = 0.42 [kg s^-1]
        Option = Mass Flow Rate
      END # MASS AND MOMENTUM:
      TURBULENCE:
        Option = Medium Intensity and Eddy Viscosity Ratio
      END # TURBULENCE:
    END # BOUNDARY CONDITIONS:
  END # BOUNDARY:IN
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: OUT
    Boundary Type = OUTLET
    Interface Boundary = Off
    Location = OUT
    BOUNDARY CONDITIONS:
      FLOW REGIME:
        Option = Subsonic
      END # FLOW REGIME:
      MASS AND MOMENTUM:
        Option = Static Pressure
        Relative Pressure = 1e5 [Pa]
```

```
      END # MASS AND MOMENTUM:
    END # BOUNDARY CONDITIONS:
  END # BOUNDARY:OUT
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: SEITE1
    Boundary Type = SYMMETRY
    Interface Boundary = Off
    Location = SEITE1
  END # BOUNDARY:SEITE1
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: SEITE2
    Boundary Type = SYMMETRY
    Interface Boundary = Off
    Location = SEITE2
  END # BOUNDARY:SEITE2
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: WAND1
    Boundary Type = WALL
    Create Other Side = Off
    Interface Boundary = Off
    Location = WAND1
    BOUNDARY CONDITIONS:
      HEAT TRANSFER:
        Option = Adiabatic
      END # HEAT TRANSFER:
      WALL INFLUENCE ON FLOW:
        Option = No Slip
      END # WALL INFLUENCE ON FLOW:
      WALL ROUGHNESS:
        Option = Smooth Wall
      END # WALL ROUGHNESS:
    END # BOUNDARY CONDITIONS:
  END # BOUNDARY:WAND1
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: WAND2
    Boundary Type = WALL
```

```
      Create Other Side = Off
      Interface Boundary = Off
      Location = WAND2
      BOUNDARY CONDITIONS:
       HEAT TRANSFER:
        Option = Adiabatic
       END # HEAT TRANSFER:
       WALL INFLUENCE ON FLOW:
        Option = No Slip
       END # WALL INFLUENCE ON FLOW:
       WALL ROUGHNESS:
        Option = Smooth Wall
       END # WALL ROUGHNESS:
      END # BOUNDARY CONDITIONS:
    END # BOUNDARY:WAND2
  END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
   INITIALISATION:
   Option = Automatic
   INITIAL CONDITIONS:
     Velocity Type = Cartesian
     CARTESIAN VELOCITY COMPONENTS:
       Option = Automatic
     END # CARTESIAN VELOCITY COMPONENTS:
     EPSILON:
       Option = Automatic
     END # EPSILON:
     K:
       Option = Automatic
     END # K:
     STATIC PRESSURE:
       Option = Automatic
     END # STATIC PRESSURE:
     TEMPERATURE:
       Option = Automatic
     END # TEMPERATURE:
   END # INITIAL CONDITIONS:
  END # INITIALISATION:
END # FLOW:
> update

>writeCaseFile operation=backup
> update

FLOW:
   SOLVER CONTROL:
   ADVECTION SCHEME:
     Option = High Resolution
   END # ADVECTION SCHEME:
   CONVERGENCE CONTROL:
     Length Scale Option = Conservative
     Maximum Number of Iterations = 35
     Timescale Control = Auto Timescale
```

```
    Timescale Factor = 1.0
  END # CONVERGENCE CONTROL:
  CONVERGENCE CRITERIA:
    Residual Target = 0.001
    Residual Type = RMS
  END # CONVERGENCE CRITERIA:
  DYNAMIC MODEL CONTROL:
    Global Dynamic Model Control = On
  END # DYNAMIC MODEL CONTROL:
 END # SOLVER CONTROL:
END # FLOW:
> update

FLOW:
  OUTPUT CONTROL:
  RESULTS:
    File Compression Level = Default
    Option = Standard
  END # RESULTS:
 END # OUTPUT CONTROL:
END # FLOW:
> update

>writeCaseFile filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/\
081024_steady.def, operation=write solver file
> update

>writeCaseFile
> update

> update

# Session file stopped:  2008/10/24 13:29:30
```

1.2.3 presession transient

```
# Session file started:  2008/10/24 13:09:31
# CFX-11.0 build 2007.08.09-23.01

COMMAND FILE:
 CFX Pre Version = 11.0
END

>load mode=new
> update

>writeCaseFile filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/\
081024_transient.cfx
> update

>gtmImport filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/icemcfd.cfx5, \
type=Generic, genOpt= -n, units=mm, nameStrategy= Assembly
> update

LIBRARY:
```

```
  CEL:
    EXPRESSIONS:
      Bw=3.03e8 [Pa]
    END
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      rho=997.15 [kg m^-3]
    END
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      gamma=7.15
    END
  END
END
> update

LIBRARY:
  CEL:
    EXPRESSIONS:
      dp=((p + Bw)/Bw)^(1/gamma)*rho
    END
  END
END
> update

# Imported library information
LIBRARY:
    MATERIAL: IAF Water
    Material Description = rho=f(t)
    Material Group = User
    Option = Pure Substance
    Thermodynamic State = Liquid
    PROPERTIES: PROPERTIES
      Option = General Material
      Thermal Expansivity = 0.000257 [K^-1]
      ABSORPTION COEFFICIENT: ABSORPTION COEFFICIENT
        Absorption Coefficient = 1.0 [m^-1]
        Option = Value
      END
      DYNAMIC VISCOSITY: DYNAMIC VISCOSITY
        Dynamic Viscosity = 0.0008899 [kg m^-1 s^-1]
        Option = Value
      END
      EQUATION OF STATE: EQUATION OF STATE
        Density = dp
        Molar Mass = 18.02 [kg kmol^-1]
```

```
      Option = Value
    END
    REFRACTIVE INDEX: REFRACTIVE INDEX
      Option = Value
      Refractive Index = 1.0
    END
    SCATTERING COEFFICIENT: SCATTERING COEFFICIENT
      Option = Value
      Scattering Coefficient = 0. [m^-1]
    END
    SPECIFIC HEAT CAPACITY: SPECIFIC HEAT CAPACITY
      Option = Value
      Specific Heat Capacity = 4181.7 [J kg^-1 K^-1]
      Specific Heat Type = Constant Pressure
    END
    THERMAL CONDUCTIVITY: THERMAL CONDUCTIVITY
      Option = Value
      Thermal Conductivity = 0.6069 [W m^-1 K^-1]
    END
    REFERENCE STATE: REFERENCE STATE
      Reference Pressure = 1 [atm]
      Reference Temperature = 25 [C]
      Reference Specific Enthalpy = 0 [J kg^-1]
      Reference Specific Entropy = 0 [J kg^-1 K^-1]
      Option = Specified Point
    END
  END
 END
END

LIBRARY:
  MATERIAL GROUP: User
  Group Description = Materials that are defined by the user
 END
END
> update

FLOW:
  SIMULATION TYPE:
  Option = Transient
  EXTERNAL SOLVER COUPLING:
    Option = None
  END # EXTERNAL SOLVER COUPLING:
  INITIAL TIME:
    Option = Automatic with Value
    Time = 0 [s]
  END # INITIAL TIME:
  TIME DURATION:
    Option = Total Time
    Total Time = 4e-1 [s]
  END # TIME DURATION:
  TIME STEPS:
    Option = Timesteps
    Timesteps = 7.5e-004 [s]
  END # TIME STEPS:
 END # SIMULATION TYPE:
```

```
END # FLOW:
> update

>writeCaseFile operation=backup
> update

FLOW:
   DOMAIN: Domain 1
   Coord Frame = Coord 0
   Domain Type = Fluid
   Fluids List = IAF Water
   Location = Assembly
   DOMAIN MODELS:
     BUOYANCY MODEL:
       Option = Non Buoyant
     END # BUOYANCY MODEL:
     DOMAIN MOTION:
       Option = Stationary
     END # DOMAIN MOTION:
     MESH DEFORMATION:
       Option = None
     END # MESH DEFORMATION:
     REFERENCE PRESSURE:
       Reference Pressure = 1e5 [Pa]
     END # REFERENCE PRESSURE:
   END # DOMAIN MODELS:
   FLUID MODELS:
     COMBUSTION MODEL:
       Option = None
     END # COMBUSTION MODEL:
     HEAT TRANSFER MODEL:
       Option = Total Energy
     END # HEAT TRANSFER MODEL:
     THERMAL RADIATION MODEL:
       Option = None
     END # THERMAL RADIATION MODEL:
     TURBULENCE MODEL:
       Option = k epsilon
     END # TURBULENCE MODEL:
     TURBULENT WALL FUNCTIONS:
       Option = Scalable
     END # TURBULENT WALL FUNCTIONS:
   END # FLUID MODELS:
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
     BOUNDARY: IN
     Boundary Type = INLET
     Interface Boundary = Off
     Location = IN
     BOUNDARY CONDITIONS:
       FLOW DIRECTION:
         Option = Normal to Boundary Condition
```

```
      END # FLOW DIRECTION:
      FLOW REGIME:
        Option = Subsonic
      END # FLOW REGIME:
      HEAT TRANSFER:
        Option = Static Temperature
        Static Temperature = 298 [K]
      END # HEAT TRANSFER:
      MASS AND MOMENTUM:
        Mass Flow Rate = 0.42 [kg s^-1]
        Option = Mass Flow Rate
      END # MASS AND MOMENTUM:
      TURBULENCE:
        Option = Medium Intensity and Eddy Viscosity Ratio
      END # TURBULENCE:
    END # BOUNDARY CONDITIONS:
  END # BOUNDARY:IN
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: OUT
    Boundary Type = OUTLET
    Interface Boundary = Off
    Location = OUT
    BOUNDARY CONDITIONS:
      FLOW REGIME:
        Option = Subsonic
      END # FLOW REGIME:
      MASS AND MOMENTUM:
        Option = Static Pressure
        Relative Pressure = 1e5 [Pa]
      END # MASS AND MOMENTUM:
    END # BOUNDARY CONDITIONS:
  END # BOUNDARY:OUT
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: SEITE1
    Boundary Type = SYMMETRY
    Interface Boundary = Off
    Location = SEITE1
  END # BOUNDARY:SEITE1
 END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
 DOMAIN: Domain 1
    BOUNDARY: SEITE2
    Boundary Type = SYMMETRY
```

```
      Interface Boundary = Off
      Location = SEITE2
    END # BOUNDARY:SEITE2
  END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
  DOMAIN: Domain 1
      BOUNDARY: WAND1
      Boundary Type = WALL
      Create Other Side = Off
      Interface Boundary = Off
      Location = WAND1
      BOUNDARY CONDITIONS:
        HEAT TRANSFER:
          Option = Adiabatic
        END # HEAT TRANSFER:
        WALL INFLUENCE ON FLOW:
          Option = No Slip
        END # WALL INFLUENCE ON FLOW:
        WALL ROUGHNESS:
          Option = Smooth Wall
        END # WALL ROUGHNESS:
      END # BOUNDARY CONDITIONS:
    END # BOUNDARY:WAND1
  END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
  DOMAIN: Domain 1
      BOUNDARY: WAND2
      Boundary Type = WALL
      Create Other Side = Off
      Interface Boundary = Off
      Location = WAND2
      BOUNDARY CONDITIONS:
        HEAT TRANSFER:
          Option = Adiabatic
        END # HEAT TRANSFER:
        WALL INFLUENCE ON FLOW:
          Option = No Slip
        END # WALL INFLUENCE ON FLOW:
        WALL ROUGHNESS:
          Option = Smooth Wall
        END # WALL ROUGHNESS:
      END # BOUNDARY CONDITIONS:
    END # BOUNDARY:WAND2
  END # DOMAIN:Domain 1
END # FLOW:
> update

FLOW:
    INITIALISATION:
    Option = Automatic
```

```
    INITIAL CONDITIONS:
      Velocity Type = Cartesian
      CARTESIAN VELOCITY COMPONENTS:
        Option = Automatic
      END # CARTESIAN VELOCITY COMPONENTS:
      EPSILON:
        Option = Automatic
      END # EPSILON:
      K:
        Option = Automatic
      END # K:
      STATIC PRESSURE:
        Option = Automatic
      END # STATIC PRESSURE:
      TEMPERATURE:
        Option = Automatic
      END # TEMPERATURE:
    END # INITIAL CONDITIONS:
  END # INITIALISATION:
END # FLOW:
> update

>writeCaseFile operation=backup
> update

FLOW:
    SOLVER CONTROL:
    ADVECTION SCHEME:
      Option = High Resolution
    END # ADVECTION SCHEME:
    CONVERGENCE CONTROL:
      Maximum Number of Coefficient Loops = 10
      Minimum Number of Coefficient Loops = 1
      Timescale Control = Coefficient Loops
    END # CONVERGENCE CONTROL:
    CONVERGENCE CRITERIA:
      Residual Target = 0.001
      Residual Type = RMS
    END # CONVERGENCE CRITERIA:
    DYNAMIC MODEL CONTROL:
      Global Dynamic Model Control = On
    END # DYNAMIC MODEL CONTROL:
  END # SOLVER CONTROL:
END # FLOW:
> update

FLOW:
    OUTPUT CONTROL:
    RESULTS:
      File Compression Level = Default
      Option = Standard
    END # RESULTS:
    TRANSIENT RESULTS: Transient Results 1
      File Compression Level = Default
      Option = Standard
      OUTPUT FREQUENCY:
```

```
      Option = Every Timestep
    END # OUTPUT FREQUENCY:
  END # TRANSIENT RESULTS:Transient Results 1
 END # OUTPUT CONTROL:
END # FLOW:
> update

>writeCaseFile filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/\
081024_transient.def, operation=write solver file
> update

>writeCaseFile
> update

> update

# Session file stopped:  2008/10/24 13:29:30
```

1.2.4 monitors

```
# Session file started:  2008/04/21 13:21:14
# CFX-11.0 build 2007.08.09-23.01

COMMAND FILE:
 CFX Pre Version = 11.0
END

FLOW:
 &replace  OUTPUT CONTROL:
  MONITOR OBJECTS:
    MONITOR BALANCES:
      Option = Full
    END # MONITOR BALANCES:
    MONITOR FORCES:
      Option = Full
    END # MONITOR FORCES:
    MONITOR PARTICLES:
      Option = Full
    END # MONITOR PARTICLES:
    MONITOR POINT: Auslass
      Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Auslass
    MONITOR POINT: Kammer1
      Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1
    MONITOR POINT: Kammer1u
      Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1u
    MONITOR POINT: Kammer2
      Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
```

```
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2
    MONITOR POINT: Kammer2u
      Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2u
    MONITOR RESIDUALS:
      Option = Full
    END # MONITOR RESIDUALS:
    MONITOR TOTALS:
      Option = Full
    END # MONITOR TOTALS:
  END # MONITOR OBJECTS:
  RESULTS:
    File Compression Level = Default
    Option = Standard
  END # RESULTS:
  TRANSIENT RESULTS: Transient Results 1
    File Compression Level = Default
    Option = Standard
    OUTPUT FREQUENCY:
      Option = Timestep Interval
      Timestep Interval = 1
    END # OUTPUT FREQUENCY:
  END # TRANSIENT RESULTS:Transient Results 1
 END # OUTPUT CONTROL:
END # FLOW:
> update

FLOW:
 &replace   OUTPUT CONTROL:
  MONITOR OBJECTS:
    MONITOR BALANCES:
      Option = Full
    END # MONITOR BALANCES:
    MONITOR FORCES:
      Option = Full
    END # MONITOR FORCES:
    MONITOR PARTICLES:
      Option = Full
    END # MONITOR PARTICLES:
    MONITOR POINT: Auslass
      Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Auslass
    MONITOR POINT: Kammer1
      Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1
    MONITOR POINT: Kammer1u
      Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
      Option = Cartesian Coordinates
```

```
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1u
    MONITOR POINT: Kammer2
      Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2
    MONITOR POINT: Kammer2u
      Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2u
    MONITOR RESIDUALS:
      Option = Full
    END # MONITOR RESIDUALS:
    MONITOR TOTALS:
      Option = Full
    END # MONITOR TOTALS:
  END # MONITOR OBJECTS:
  RESULTS:
    File Compression Level = Default
    Option = Standard
  END # RESULTS:
  TRANSIENT RESULTS: Transient Results 1
    File Compression Level = Default
    Option = Standard
    OUTPUT FREQUENCY:
      Option = Timestep Interval
      Timestep Interval = 1
    END # OUTPUT FREQUENCY:
  END # TRANSIENT RESULTS:Transient Results 1
 END # OUTPUT CONTROL:
END # FLOW:
> update

FLOW:
 &replace   OUTPUT CONTROL:
  MONITOR OBJECTS:
    MONITOR BALANCES:
      Option = Full
    END # MONITOR BALANCES:
    MONITOR FORCES:
      Option = Full
    END # MONITOR FORCES:
    MONITOR PARTICLES:
      Option = Full
    END # MONITOR PARTICLES:
    MONITOR POINT: Auslass
      Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Auslass
    MONITOR POINT: Kammer1
      Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
```

```
      END # MONITOR POINT:Kammer1
      MONITOR POINT: Kammer1u
        Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer1u
      MONITOR POINT: Kammer2
        Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer2
      MONITOR POINT: Kammer2u
        Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer2u
      MONITOR RESIDUALS:
        Option = Full
      END # MONITOR RESIDUALS:
      MONITOR TOTALS:
        Option = Full
      END # MONITOR TOTALS:
    END # MONITOR OBJECTS:
    RESULTS:
      File Compression Level = Default
      Option = Standard
    END # RESULTS:
    TRANSIENT RESULTS: Transient Results 1
      File Compression Level = Default
      Option = Standard
      OUTPUT FREQUENCY:
        Option = Timestep Interval
        Timestep Interval = 1
      END # OUTPUT FREQUENCY:
    END # TRANSIENT RESULTS:Transient Results 1
  END # OUTPUT CONTROL:
END # FLOW:
> update

FLOW:
  &replace   OUTPUT CONTROL:
    MONITOR OBJECTS:
      MONITOR BALANCES:
        Option = Full
      END # MONITOR BALANCES:
      MONITOR FORCES:
        Option = Full
      END # MONITOR FORCES:
      MONITOR PARTICLES:
        Option = Full
      END # MONITOR PARTICLES:
      MONITOR POINT: Auslass
        Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Auslass
```

```
      MONITOR POINT: Kammer1
        Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer1
      MONITOR POINT: Kammer1u
        Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer1u
      MONITOR POINT: Kammer2
        Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer2
      MONITOR POINT: Kammer2u
        Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
        Option = Cartesian Coordinates
        Output Variables List = Pressure
      END # MONITOR POINT:Kammer2u
      MONITOR RESIDUALS:
        Option = Full
      END # MONITOR RESIDUALS:
      MONITOR TOTALS:
        Option = Full
      END # MONITOR TOTALS:
    END # MONITOR OBJECTS:
    RESULTS:
      File Compression Level = Default
      Option = Standard
    END # RESULTS:
    TRANSIENT RESULTS: Transient Results 1
      File Compression Level = Default
      Option = Standard
      OUTPUT FREQUENCY:
        Option = Timestep Interval
        Timestep Interval = 1
      END # OUTPUT FREQUENCY:
    END # TRANSIENT RESULTS:Transient Results 1
  END # OUTPUT CONTROL:
END # FLOW:
> update

FLOW:
  &replace   OUTPUT CONTROL:
    MONITOR OBJECTS:
      MONITOR BALANCES:
        Option = Full
      END # MONITOR BALANCES:
      MONITOR FORCES:
        Option = Full
      END # MONITOR FORCES:
      MONITOR PARTICLES:
        Option = Full
      END # MONITOR PARTICLES:
      MONITOR POINT: Auslass
```

```
      Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Auslass
    MONITOR POINT: Kammer1
      Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1
    MONITOR POINT: Kammer1u
      Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1u
    MONITOR POINT: Kammer2
      Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2
    MONITOR POINT: Kammer2u
      Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2u
    MONITOR RESIDUALS:
      Option = Full
    END # MONITOR RESIDUALS:
    MONITOR TOTALS:
      Option = Full
    END # MONITOR TOTALS:
  END # MONITOR OBJECTS:
  RESULTS:
    File Compression Level = Default
    Option = Standard
  END # RESULTS:
  TRANSIENT RESULTS: Transient Results 1
    File Compression Level = Default
    Option = Standard
    OUTPUT FREQUENCY:
      Option = Timestep Interval
      Timestep Interval = 1
    END # OUTPUT FREQUENCY:
  END # TRANSIENT RESULTS:Transient Results 1
 END # OUTPUT CONTROL:
END # FLOW:
> update

FLOW:
 &replace   OUTPUT CONTROL:
  MONITOR OBJECTS:
    MONITOR BALANCES:
      Option = Full
    END # MONITOR BALANCES:
    MONITOR FORCES:
      Option = Full
    END # MONITOR FORCES:
```

```
    MONITOR PARTICLES:
      Option = Full
    END # MONITOR PARTICLES:
    MONITOR POINT: Auslass
      Cartesian Coordinates = 0.095 [m], 0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Auslass
    MONITOR POINT: Kammer1
      Cartesian Coordinates = 0.026 [m], 0.026 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1
    MONITOR POINT: Kammer1u
      Cartesian Coordinates = 0.026 [m], -0.009 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer1u
    MONITOR POINT: Kammer2
      Cartesian Coordinates = 0.065 [m], 0.037 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2
    MONITOR POINT: Kammer2u
      Cartesian Coordinates = 0.065 [m], -0.02 [m], 0 [m]
      Option = Cartesian Coordinates
      Output Variables List = Pressure
    END # MONITOR POINT:Kammer2u
    MONITOR RESIDUALS:
      Option = Full
    END # MONITOR RESIDUALS:
    MONITOR TOTALS:
      Option = Full
    END # MONITOR TOTALS:
  END # MONITOR OBJECTS:
  RESULTS:
    File Compression Level = Default
    Option = Standard
  END # RESULTS:
  TRANSIENT RESULTS: Transient Results 1
    File Compression Level = Default
    Option = Standard
    OUTPUT FREQUENCY:
      Option = Timestep Interval
      Timestep Interval = 1
    END # OUTPUT FREQUENCY:
  END # TRANSIENT RESULTS:Transient Results 1
 END # OUTPUT CONTROL:
END # FLOW:
> update

> update

# Session file stopped:  2008/04/21 13:21:40
```

1.2.5 postsession

```
# Session file started:  2008/10/24 11:13:48
# CFX-11.0 build 2007.08.09-23.01

# To avoid unnecessary file pre-processing and modifications, include
# COMMAND FILE at the top of your session file.
# If it is not included, the file is assumed to be older and will be
# modified for backward compatibility.
COMMAND FILE:
  CFX Post Version = 11.0
END

DATA READER:

  Clear All Objects = false
  Append Results = false
  Apply X Offset = false
  Apply Y Offset = false
  Apply Z Offset = false
  Keep Camera Position = true
  Load Particle Tracks = true
END

DATA READER:
  Domains to Load=
END
> load filename=E:/Narrain/080429_WS_Laborversuch/081024_CFD/\
081024_transient_001.res


POINT:Point 1
  Apply Instancing Transform = On
  Colour = 1, 1, 0
  Colour Map = Rainbow
  Colour Mode = Constant
  Colour Scale = Linear
  Colour Variable = Pressure
  Colour Variable Boundary Values = Hybrid
  Culling Mode = No Culling
  Domain List = All Domains
  Draw Faces = On
  Draw Lines = Off
  Instancing Transform = Default Transform
  Lighting = On
  Line Width = 2
  Max = 0.0 [Pa]
  Min = 0.0 [Pa]
  Node Number = 1
  Option = XYZ
  Point = 0.102 [m], 0.0085 [m], 0 [m]
  Point Symbol = Crosshair
  Range = Global
  Specular Lighting = On
  Surface Drawing = Smooth Shading
```

```
  Symbol Size = 1.0
  Transparency = 0.0
  Variable = Pressure
  Variable Boundary Values = Hybrid
  OBJECT VIEW TRANSFORM:
    Apply Reflection = Off
    Apply Rotation = Off
    Apply Scale = Off
    Apply Translation = Off
    Principal Axis = Z
    Reflection Plane Option = XY Plane
    Rotation Angle = 0.0 [degree]
    Rotation Axis From = 0 [m], 0 [m], 0 [m]
    Rotation Axis To = 0 [m], 0 [m], 0 [m]
    Rotation Axis Type = Principal Axis
    Scale Vector = 1 , 1 , 1
    Translation Vector = 0 [m], 0 [m], 0 [m]
    X = 0.0 [m]
    Y = 0.0 [m]
    Z = 0.0 [m]
  END
END

# Sending visibility action from ViewUtilities
>show /POINT:Point 1, view=/VIEW:View 1

CHART:Chart 1
  Chart Axes Font = Tahoma, 10, False, False
  Chart Axes Titles Font = Tahoma, 10, True, False
  Chart Grid Line Width = 1
  Chart Horizontal Grid = On
  Chart Legend = On
  Chart Legend Font = Tahoma, 8, False, False
  Chart Legend Position = Bottom
  Chart Line Width = 2
  Chart Minor Grid = Off
  Chart Minor Grid Line Width = 1
  Chart Symbol Size = 4
  Chart Title = Title
  Chart Title Font = Tahoma, 12, True, False
  Chart Type = Time
  Chart Vertical Grid = On
  Chart X Axis Label = X Axis <units>
  Chart Y Axis Label = Y Axis <units>
  Max X = 1.0
  Max Y = 1.0
  Min X = -1.0
  Min Y = -1.0
  Use Data For Axis Labels = On
  X Axis Automatic Range = On
  X Axis Inverted = Off
  X Axis Logarithmic Scaling = Off
  Y Axis Automatic Range = On
  Y Axis Inverted = Off
  Y Axis Logarithmic Scaling = Off
  CHART LINE:Chart Line 1
```

```
    Auto Chart Line Colour = On
    Chart Line Colour = 1.0, 0.0, 0.0
    Chart Line Filename =
    Chart Line Style = Automatic
    Chart Line Type = Regular
    Chart Symbol Colour = 0.0, 1.0, 0.0
    Chart Symbol Style = None
    Chart X Variable = Chart Count
    Chart Y Variable = Density
    Line Name = New Line
    Time Chart Location = Point 1
    Time Chart Type = Point
    Time Chart Variable = Total Pressure
    Time Variable Absolute Value = Off
    Time Variable Boundary Values = Conservative
    X Variable Absolute Value = Off
    X Variable Boundary Values = Conservative
    Y Variable Absolute Value = Off
    Y Variable Boundary Values = Conservative
  END
END

>chart refresh=/CHART:Chart 1

EXPORT:
  Export File = E:/Narrain/080429_WS_Laborversuch/081024_CFD/081024_trn.txt
  Export Chart Name = Chart 1
  Overwrite = On
END
>export chart


# Session file stopped:  2008/10/24 11:24:04
```

1.2.6 Excel Makro für FFT

(Fourier Transformation)

```
Sub Frequenz080911()
'
' Frequenz080911 Makro
' Makro am 14.05.2008 von narrain aufgezeichnet
'
   Workbooks.OpenText Filename:= _
      "E:\Narrain\080429_WS_Laborversuch\080911_CFD\080911_k2_trn_15Hz.txt",
Origin:=xlMSDOS, _
      StartRow:=1, DataType:=xlDelimited, TextQualifier:=xlDoubleQuote, _
      ConsecutiveDelimiter:=False, Tab:=True, Semicolon:=False, Comma:=True, _
      Space:=False, Other:=False, FieldInfo:=Array(Array(1, 1), Array(2, 1)), _
      DecimalSeparator:=".", ThousandsSeparator:=" ", TrailingMinusNumbers:= _
      True
    Application.Run "ATPVBAEN.XLA!Fourier", ActiveSheet.Range("$B$6:$B$517"), _
      ActiveSheet.Range("$C$6:$C$517"), False, False
```

```
Range("D6").Select
ActiveCell.FormulaR1C1 = "=IMABS(RC[-1])"
Range("D6").Select
Selection.AutoFill Destination:=Range("D6:D517")
Range("D6:D517").Select


 Application.Run "ATPVBAEN.XLA!Fourier", ActiveSheet.Range("$B$574:$B$1085"), _
   ActiveSheet.Range("$C$574:$C$1085"), False, False

Range("D574").Select
ActiveCell.FormulaR1C1 = "=IMABS(RC[-1])"
Range("D574").Select
Selection.AutoFill Destination:=Range("D574:D1085")
Range("D574:D1085").Select


 Application.Run "ATPVBAEN.XLA!Fourier", ActiveSheet.Range("$B$1142:$B$1653"), _
   ActiveSheet.Range("$C$1142:$C$1653"), False, False

Range("D1142").Select
ActiveCell.FormulaR1C1 = "=IMABS(RC[-1])"
Range("D1142").Select
Selection.AutoFill Destination:=Range("D1142:D1653")
Range("D1142:D1653").Select

    Application.Run "ATPVBAEN.XLA!Fourier", ActiveSheet.Range("$B$1710:$B$2221"), _
   ActiveSheet.Range("$C$1710:$C$2221"), False, False

Range("D1710").Select
ActiveCell.FormulaR1C1 = "=IMABS(RC[-1])"
Range("D1710").Select
Selection.AutoFill Destination:=Range("D1710:D2221")
Range("D1710:D2221").Select

    Application.Run "ATPVBAEN.XLA!Fourier", ActiveSheet.Range("$B$2278:$B$2789"), _
   ActiveSheet.Range("$C$2278:$C$2789"), False, False

Range("D2278").Select
ActiveCell.FormulaR1C1 = "=IMABS(RC[-1])"
Range("D2278").Select
Selection.AutoFill Destination:=Range("D2278:D2789")
Range("D2278:D2789").Select


Range("D5").Select
ActiveCell.FormulaR1C1 = "Druck"
Range("E5").Select
ActiveCell.FormulaR1C1 = "Zeitschritt"



Range("E6").Select
ActiveCell.FormulaR1C1 = "=(RC[-4]-R6C1)"
Range("D6:D517").Select
Range("E6").Select
```

```
Selection.AutoFill Destination:=Range("E6:E517")

Range("E574").Select
ActiveCell.FormulaR1C1 = "=(RC[-4]-R6C1)"
Range("D574:D1085").Select
Range("E574").Select
Selection.AutoFill Destination:=Range("E574:E1085")

Range("E1142").Select
ActiveCell.FormulaR1C1 = "=(RC[-4]-R6C1)"
Range("D1142:D1653").Select
Range("E1142").Select
Selection.AutoFill Destination:=Range("E1142:E1653")


Range("E1710").Select
ActiveCell.FormulaR1C1 = "=(RC[-4]-R6C1)"
Range("D1710:D2221").Select
Range("E1710").Select
Selection.AutoFill Destination:=Range("E1710:E2221")

Range("E2278").Select
ActiveCell.FormulaR1C1 = "=(RC[-4]-R6C1)"
Range("D2278:D2789").Select
Range("E2278").Select
Selection.AutoFill Destination:=Range("E2278:E2789")

Range("G1").Select
ActiveCell.FormulaR1C1 = "Tges ="
Range("H1").Select
ActiveCell.FormulaR1C1 = "=R[516]C[-3]-R[5]C[-3]"
Range("G2").Select
ActiveCell.FormulaR1C1 = "Abtastrate ="
Range("H2").Select
ActiveCell.FormulaR1C1 = "=1/(R[10]C[-7]-R[9]C[-7])"
Range("G3").Select
ActiveCell.FormulaR1C1 = "Anzahl, Werte ="
Range("H3").Select
ActiveCell.FormulaR1C1 = "512"
Range("G4").Select
ActiveCell.FormulaR1C1 = "T = Anz/Abtast ="
Range("H4").Select
ActiveCell.FormulaR1C1 = "=R3C8/R2C8"
Range("G5").Select
ActiveCell.FormulaR1C1 = "delta f = 1/T ="
Range("H5").Select
ActiveCell.FormulaR1C1 = "1/"
Range("H5").Select
ActiveCell.FormulaR1C1 = "=1/R4C8"
Range("F5").Select
ActiveCell.FormulaR1C1 = "delta f"


Range("F6").Select
ActiveCell.FormulaR1C1 = "0"
Range("F7").Select
```

```
ActiveCell.FormulaR1C1 = "=R[-1]C+R5C8"
Range("F7").Select
Selection.AutoFill Destination:=Range("F7:F517")


Range("F574").Select
ActiveCell.FormulaR1C1 = "0"
Range("F575").Select
ActiveCell.FormulaR1C1 = "=R[-1]C+R5C8"
Range("F575").Select
Selection.AutoFill Destination:=Range("F575:F1085")

Range("F1142").Select
ActiveCell.FormulaR1C1 = "0"
Range("F1143").Select
ActiveCell.FormulaR1C1 = "=R[-1]C+R5C8"
Range("F1143").Select
Selection.AutoFill Destination:=Range("F1143:F1653")

Range("F1710").Select
ActiveCell.FormulaR1C1 = "0"
Range("F1711").Select
ActiveCell.FormulaR1C1 = "=R[-1]C+R5C8"
Range("F1711").Select
Selection.AutoFill Destination:=Range("F1711:F2221")

Range("F2278").Select
ActiveCell.FormulaR1C1 = "0"
Range("F2279").Select
ActiveCell.FormulaR1C1 = "=R[-1]C+R5C8"
Range("F2279").Select
Selection.AutoFill Destination:=Range("F2279:F2789")


Charts.Add
ActiveChart.ChartType = xlXYScatterSmoothNoMarkers
ActiveChart.SetSourceData Source:=Sheets("080911_k2_trn_15Hz").Range("J10" _
   ), PlotBy:=xlColumns
ActiveChart.SeriesCollection.NewSeries
ActiveChart.SeriesCollection.NewSeries
ActiveChart.SeriesCollection.NewSeries
ActiveChart.SeriesCollection.NewSeries
ActiveChart.SeriesCollection.NewSeries
ActiveChart.SeriesCollection(1).XValues = "='080911_k2_trn_15Hz'!R7C6:R517C6"
ActiveChart.SeriesCollection(1).Values = "='080911_k2_trn_15Hz'!R7C4:R517C4"
ActiveChart.SeriesCollection(1).Name = "='080911_k2_trn_15Hz'!R2C1"
ActiveChart.SeriesCollection(2).XValues = "='080911_k2_trn_15Hz'!R575C6:R1085C6"
ActiveChart.SeriesCollection(2).Values = "='080911_k2_trn_15Hz'!R575C4:R1085C4"
ActiveChart.SeriesCollection(2).Name = "='080911_k2_trn_15Hz'!R570C1"
ActiveChart.SeriesCollection(3).XValues = _
   "='080911_k2_trn_15Hz'!R1143C6:R1653C6"
ActiveChart.SeriesCollection(3).Values = "='080911_k2_trn_15Hz'!R1143C4:R1653C4"
ActiveChart.SeriesCollection(3).Name = "='080911_k2_trn_15Hz'!R1138C1"
ActiveChart.SeriesCollection(4).XValues = _
   "='080911_k2_trn_15Hz'!R1711C6:R2221C6"
ActiveChart.SeriesCollection(4).Values = "='080911_k2_trn_15Hz'!R1711C4:R2221C4"
```

```
ActiveChart.SeriesCollection(4).Name = "='080911_k2_trn_15Hz'!R1706C1"
ActiveChart.SeriesCollection(5).XValues = _
   "='080911_k2_trn_15Hz'!R2279C6:R2789C6"
ActiveChart.SeriesCollection(5).Values = "='080911_k2_trn_15Hz'!R2279C4:R2789C4"
ActiveChart.SeriesCollection(5).Name = "='080911_k2_trn_15Hz'!R2274C1"
ActiveChart.Location Where:=xlLocationAsObject, Name:="080911_k2_trn_15Hz"

With ActiveChart
   .HasTitle = True
   .ChartTitle.Characters.Text = "080911_k2_trn_15Hz"
   .Axes(xlCategory, xlPrimary).HasTitle = True
   .Axes(xlCategory, xlPrimary).AxisTitle.Characters.Text = "[Hz]"
   .Axes(xlValue, xlPrimary).HasTitle = True
   .Axes(xlValue, xlPrimary).AxisTitle.Characters.Text = "[Pa]"
End With
With ActiveChart.Axes(xlCategory)
   .HasMajorGridlines = True
   .HasMinorGridlines = False
End With
With ActiveChart.Axes(xlValue)
   .HasMajorGridlines = True
   .HasMinorGridlines = False
End With
ActiveChart.Legend.Select
Selection.Top = 15
ActiveChart.PlotArea.Select
With Selection.Border
   .ColorIndex = 16
   .Weight = xlThin
   .LineStyle = xlContinuous
End With
Selection.Interior.ColorIndex = xlNone
ActiveChart.Axes(xlCategory).MajorGridlines.Select
With Selection.Border
   .ColorIndex = 57
   .Weight = xlHairline
   .LineStyle = xlDot
End With
ActiveChart.Axes(xlValue).MajorGridlines.Select
With Selection.Border
   .ColorIndex = 57
   .Weight = xlHairline
   .LineStyle = xlDot
End With

ActiveChart.Axes(xlCategory).Select
With ActiveChart.Axes(xlCategory)
   .MinimumScaleIsAuto = True
   .MaximumScale = 500
   .MinorUnitIsAuto = True
   .MajorUnit = 100
   .Crosses = xlAutomatic
   .ReversePlotOrder = False
   .ScaleType = xlLinear
   .DisplayUnit = xlNone
End With
```

```
ActiveChart.Axes(xlValue).Select
With ActiveChart.Axes(xlValue)
    .MinimumScale = 0
    .MaximumScale = 250000
    .MinorUnit = 5000
    .MajorUnit = 50000
    .Crosses = xlAutomatic
    .ReversePlotOrder = False
    .ScaleType = xlLinear
    .DisplayUnit = xlNone
End With


ActiveChart.ChartArea.Select
ActiveSheet.Shapes("Diagramm 1").ScaleWidth 1.49, msoFalse, _
    msoScaleFromTopLeft
ActiveSheet.Shapes("Diagramm 1").ScaleHeight 1.1, msoFalse, _
    msoScaleFromTopLeft
ChDir "E:\Narrain\080429_WS_Laborversuch"
ActiveWorkbook.SaveAs Filename:= _
    "E:\Narrain\080429_WS_Laborversuch\080911_CFD\080911_k2_trn.xls", FileFormat:= _
    xlNormal, Password:="", WriteResPassword:="", ReadOnlyRecommended:=False _
    , CreateBackup:=False
ActiveSheet.ChartObjects("Diagramm 1").Activate
```

1.3 DOS BATCH Files

```
echo ICEM Geometrie
"D:\Programme\ANSYS Inc\v110\icemcfd\bin\icemcfd.exe" -batch -script icemcfd_tin.rpl
echo ICEM Netzgenerierung
"D:\Programme\ANSYS Inc\v110\icemcfd\bin\icemcfd.exe" -batch -script icemcfd_hex.rpl
echo ICEM cfx5Konvertierung
"D:\Programme\ANSYS Inc\v110\icemcfd\bin\icemcfd.exe" -batch -script icemcfd_con.rpl
echo CFX Pre steady
"D:\Programme\ANSYS Inc\v110\CFX\win\cfx5pre" -batch pre_ste.pre
echo CFX Pre transient
"D:\Programme\ANSYS Inc\v110\CFX\win\cfx5pre" -batch pre_trn.pre
echo 081024_ste
"D:\Programme\ANSYS Inc\v110\CFX\win\cfx5solve" -def Duese_ste.def
echo 081024_trn
"D:\Programme\ANSYS Inc\v110\CFX\win\cfx5solve" -def Duese_trn.def –ini_Duese_ste_001.res
echo 081024_trn_post
"D:\Programme\ANSYS Inc\v110\CFX\win\cfx5post" -batch post.cse
```