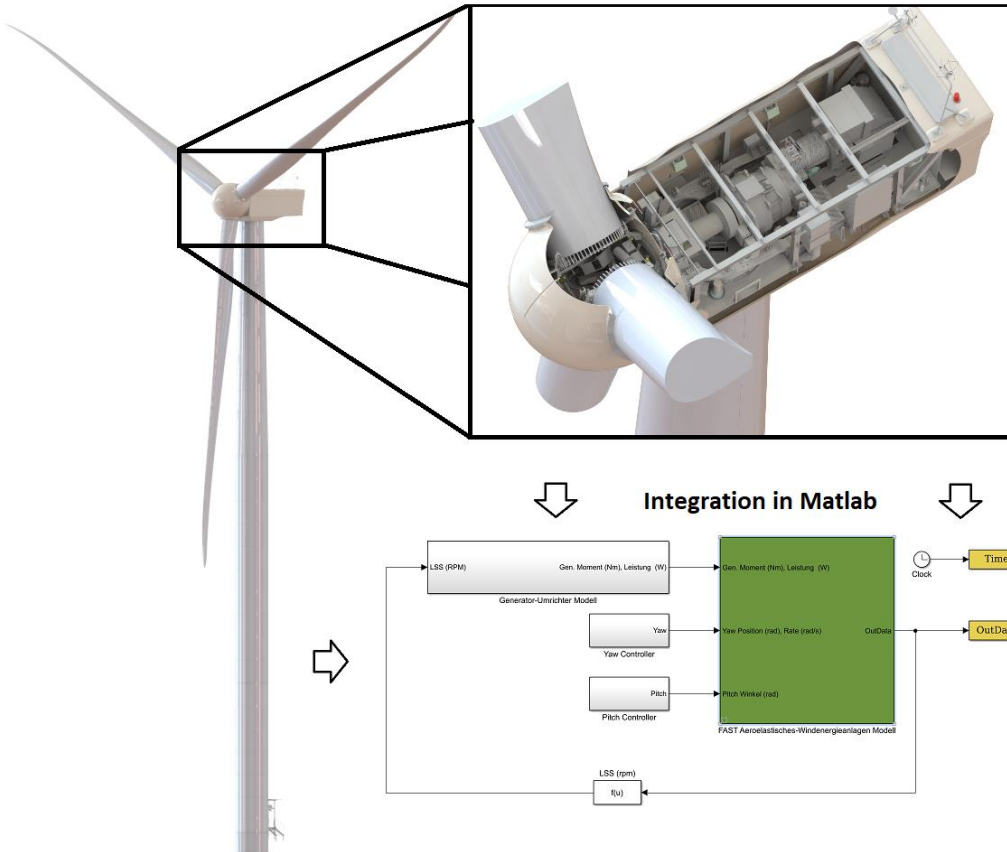


## General Information:

- The topics listed in this document are suggestions for theses and student projects including
  - Bachelor theses,
  - Software Lab Projects / Pre-Theses and
  - Master theses.
- The specific task will be concretized in consultation with the student.
- Interested students are asked to contact the responsible person stated under contact via phone or e-mail.

### Contact:

PROF. UWE RITSCHEL  
Statikgebäude – Raum 10  
☎ (0381) 498-9570  
✉ [uwe.ritschel@uni-rostock.de](mailto:uwe.ritschel@uni-rostock.de)



## Responsibilities

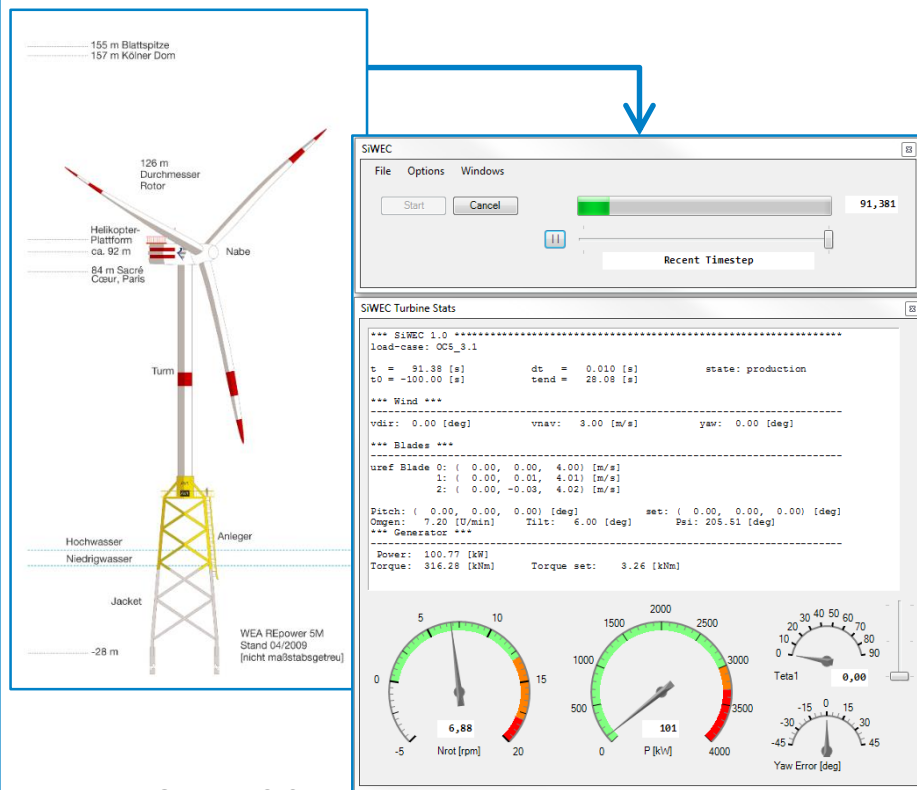
- Development of mathematical models of electromechanical components for wind turbines
- Design and development of control strategies for single wind turbines and windfarms
- Modeling with MATLAB, Simulink and OpenFAST

## Rotor Blades and Tower

- Extensions in the mathematical description of the tower by modal shape functions
- Implementation of enhanced modal decomposition methods for the rotor blade model
- Development of new structural models for rotor blades based on the finite element method (FEM)

## Jacket / Foundation

- Enhancement of the structural mechanic model for jacket and foundation
- Implementation of external forces on the jacket (e.g. wave forces)
- Validation of simulation results against measurements

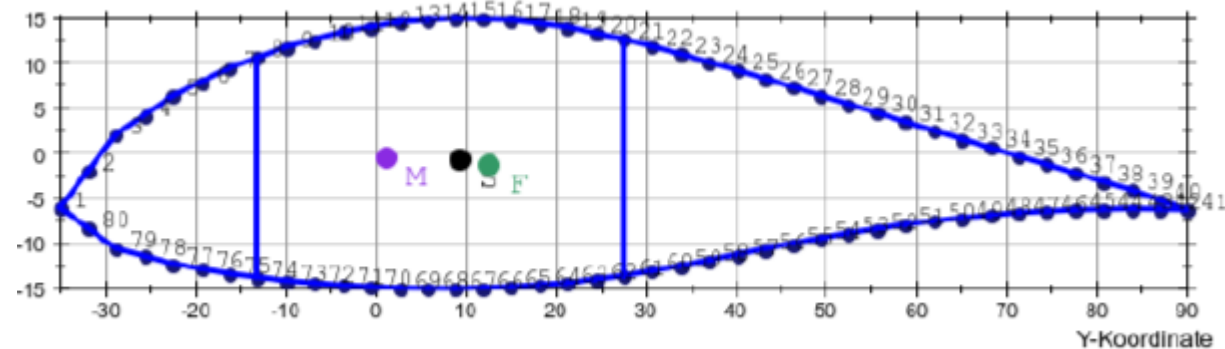
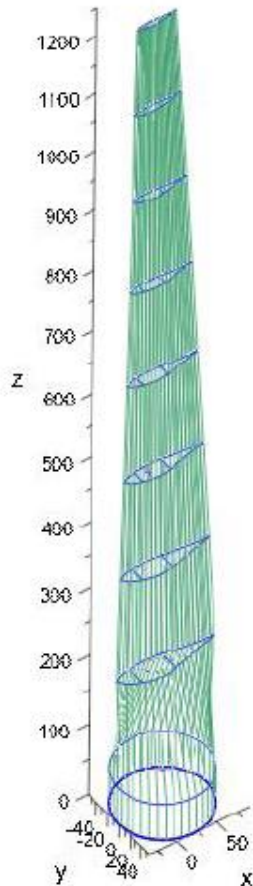


## What's SiWEC?

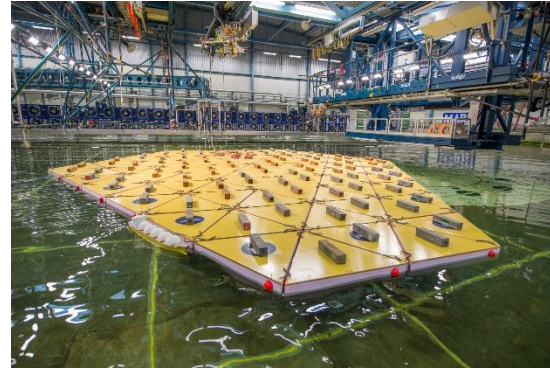
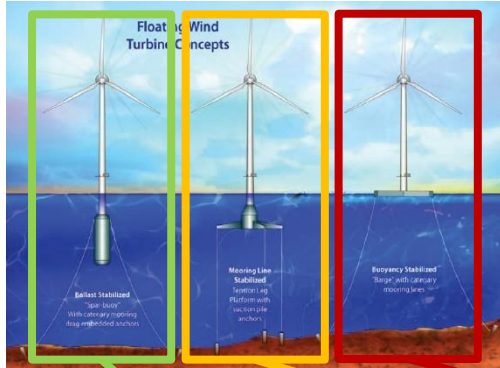
- SiWEC is an aero-elastic code for load simulations of wind turbines written in C#.

## Scope

- Enhancement of a MATLAB tool for calculating the profile data of thin-walled rotor blades
- Programming of an object oriented computer tool for calculating the cross section stiffness and mass data for rotor blade airfoils in C#

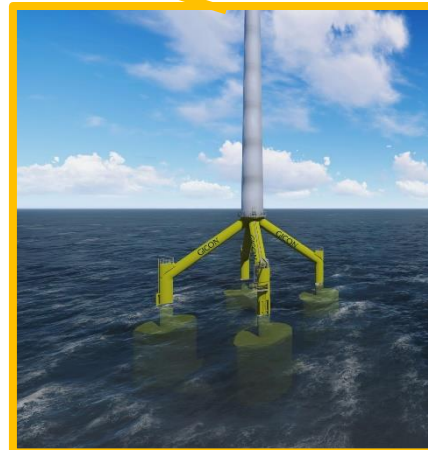


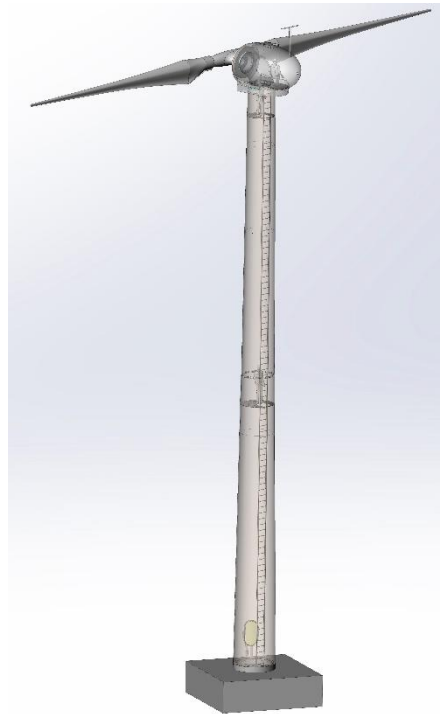
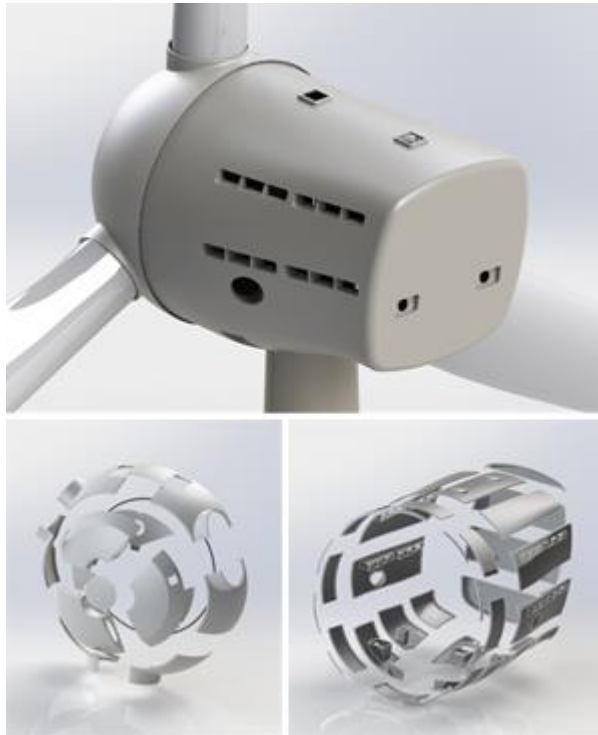
# Floating Sub-Structures for Offshore Applications



## Scope

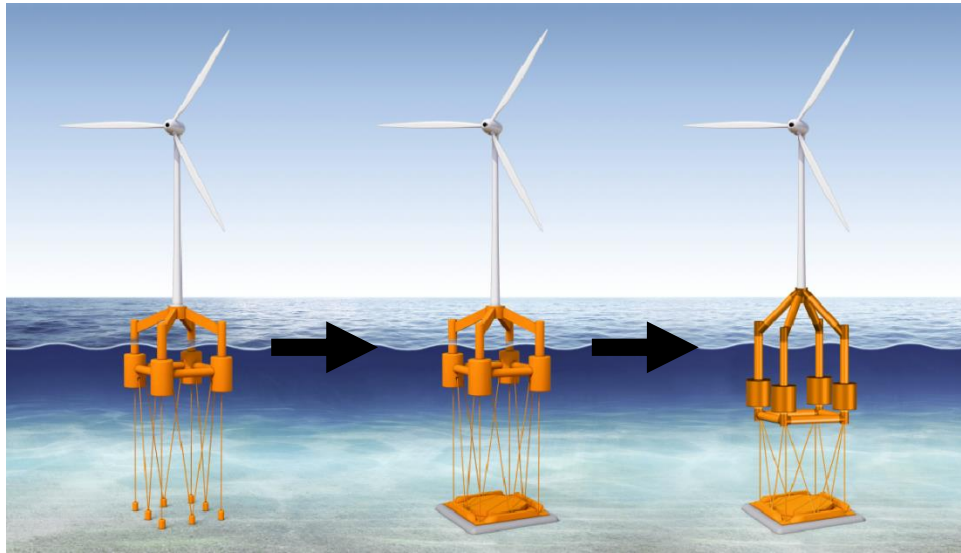
- Application of novel materials and manufacturing techniques for offshore substructures
- Optimizing the structure of floating substructures using FEM
- Logistics for installation, operation and dismantling





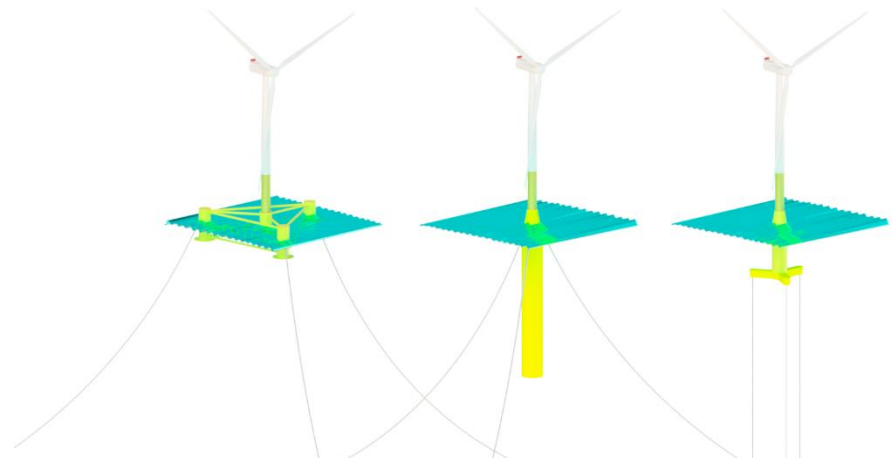
## Scope

- Constructive extension and further development of wind turbine concepts and / or wind turbine components
- Economic structure optimization with ANSYS and CAD for wind turbines and / or its components
- Sector coupling with a wind turbine as the core of a renewable energy system

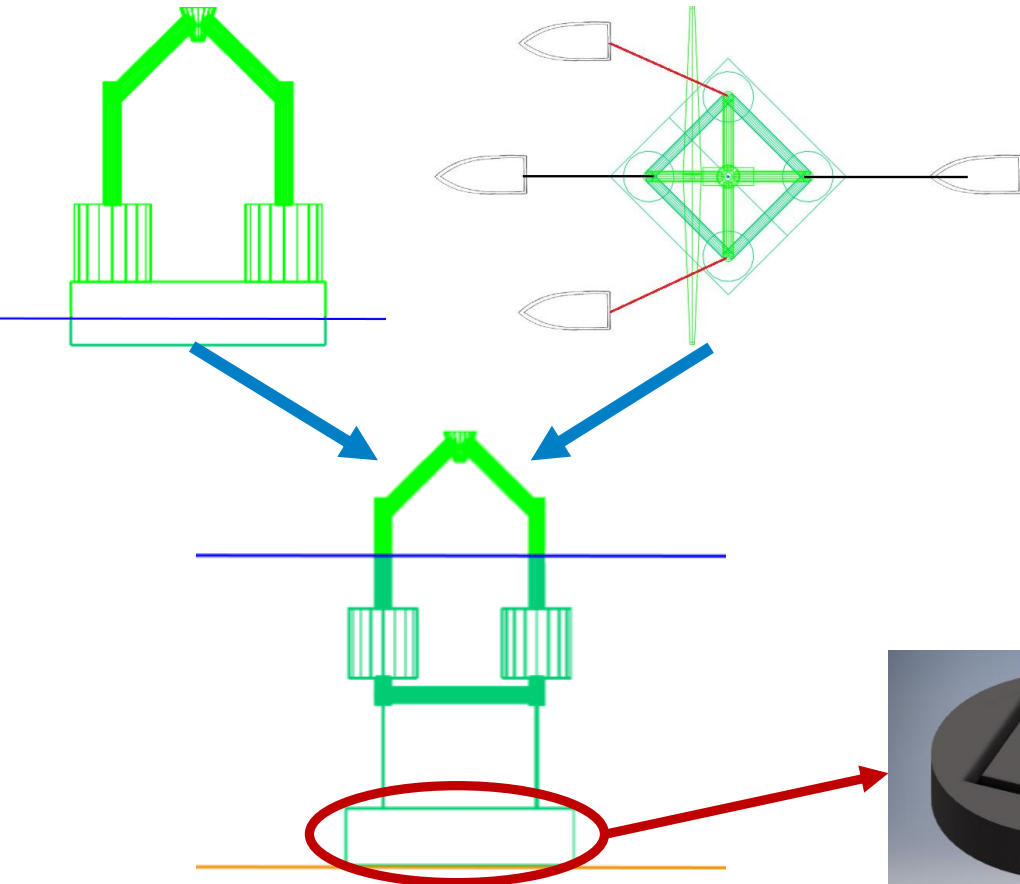


## Scope:

- Concept development for the design of innovative substructures and their single parts
- Parameter study based design optimization with Bentley Moses
- Design of various floating substructures with ANSYS Aqwa



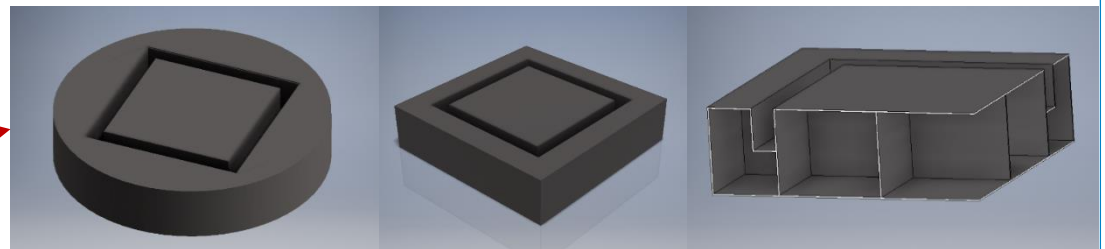
## Transport Process



## Installed Substructure

## Scope:

- Simulation of hydrodynamic effects during the installation process with ANSYS Aqwa and via CFD
- Design and optimization of gravity based anchor systems using ANSYS Aqwa
- Performing feasibility studies for installation concepts



## Tasks

- Modal analysis of floating wind turbines
- Investigation of the dynamic behaviour of platform and wind turbine with OpenFAST
- Comparison of different mooring models (quasistatic, dynamic) in OpenFAST
- Study on the impact of certain simulation parameters of OpenFAST
- Implementation of substructures in ANSYS Aqwa and coupling with OpenFAST

```

----- SERVODYN v1.05.* INPUT FILE -----
DOWEC 6MW control system properties for use of DISCON_x64.dll

True      Echo      - Echo input data to <RootName>.ech
"default" DT         - Communication interval for contrc

----- SIMULATION CONTROL -----
5 PCMode      - Pitch control mode (0: none, 3: u
0 TPCOn       - Time to enable active pitch contr
9999.9 TPitManS(1) - Time to start override pitch mane
9999.9 TPitManS(2) - Time to start override pitch mane
9999.9 TPitManS(3) - Time to start override pitch mane
2 PitManRat(1) - Pitch rate at which override pitc
2 PitManRat(2) - Pitch rate at which override pitc
2 PitManRat(3) - Pitch rate at which override pitc
0 BlPitchF(1)  - Blade 1 final pitch for pitch man
0 BlPitchF(2)  - Blade 2 final pitch for pitch man
0 BlPitchF(3)  - Blade 3 final pitch for pitch man

----- GENERATOR AND TORQUE CONTROL -----
5 VSContrl    - Variable-speed control mode (0: n
2 GenModel    - Generator model (1: simple, 2: Th
94.4 GenEff    - Generator efficiency (ignored by
True GenTiStr  - Method to start the generator (T:
True GenTiStp  - Method to stop the generator (T:
9999.9 SpdGenOn - Generator speed to turn on the ge
0 TimGenOn    - Time to turn on the generator for
9999.9 TimGenOf - Time to turn off the generator (s
    
```

```

PROGRAM FAST
USE FAST Subs ! all of the ModuleName and ModuleName_types modules are inherited from
IMPLICIT NONE

! Local parameters:
REAL(DbKl), PARAMETER :: t_initial = 0.0_DbKl
INTEGER(IntKi), PARAMETER :: NumTurbines = 1

! Other/misc variables
TYPE(FAST_TurbineType) :: Turbine(NumTurbines)

INTEGER(IntKi) :: i_turb
INTEGER(IntKi) :: n_t_global
INTEGER(IntKi) :: ErrStat
CHARACTER(1024) :: ErrMsg

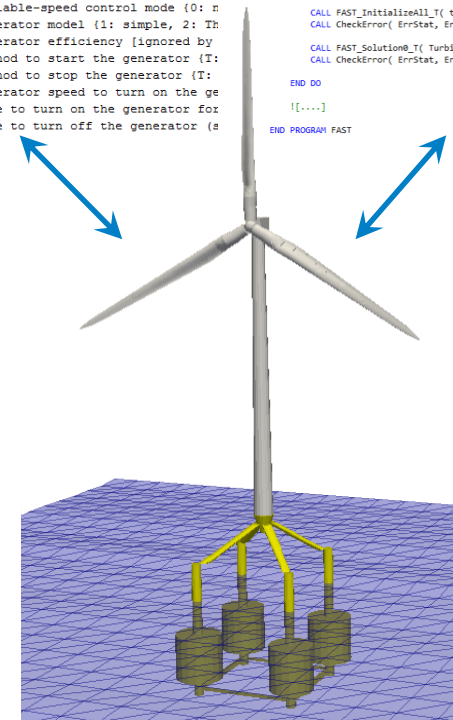
CALL MwTC_Init() ! open console for writing
ProgramName = "FAST"
CheckpointRoot = ""
CALL CheckArgs( CheckpointRoot, ErrStat, Flag=FlagArg )

Restart_step = 0

DO i_turb = 1, NumTurbines
    CALL FAST_InitializeAll_T( t_initial, i_turb, Turbine(i_turb), ErrStat, ErrMsg )
    CALL CheckError( ErrStat, ErrMsg, 'during module initialization' )

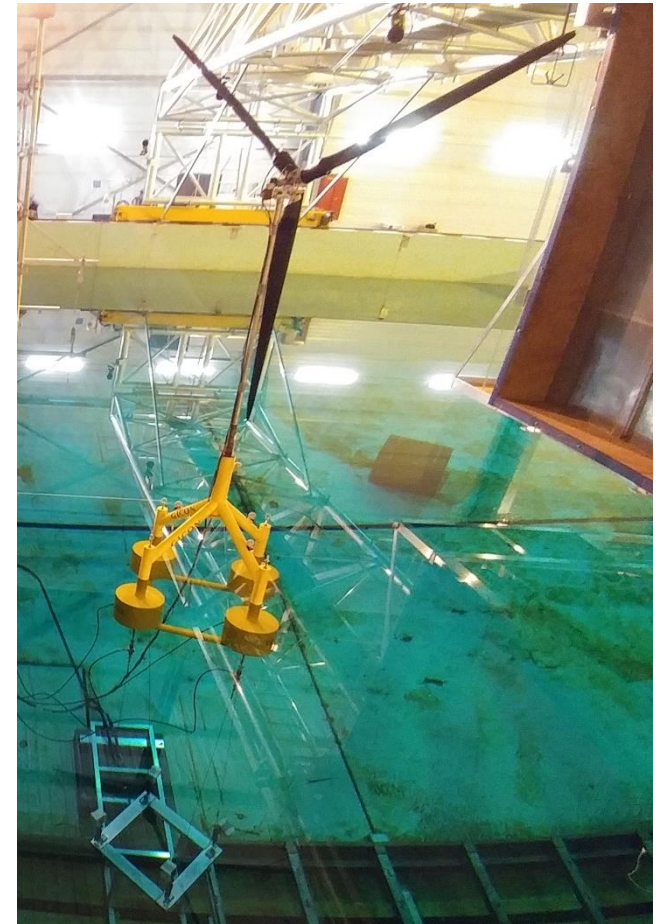
    CALL FAST_Solution@_T( Turbine(i_turb), ErrStat, ErrMsg )
    CALL CheckError( ErrStat, ErrMsg, 'during simulation initialization' )
END DO

! [...]
END PROGRAM FAST
    
```



## Scope:

- Preparation and construction of models for scaled towing and installation (T&I) tests including a lowerable gravity foundation
- Evaluation of results of T&I tests
- Evaluation of model tests for the determination of operating loads
- Creation of a 1:50 model in OpenFAST and comparison of results of physical model tests and simulations



## Tasks

- Design of optimized scaled rotor blades
- CFD-Analysis of different airfoils to determine lift and drag coefficients
- CFD-Analysis of a turning rotor to determine thrust and power coefficients
- Experimental Analysis of scaled rotor blades and rotors in a wind tunnel

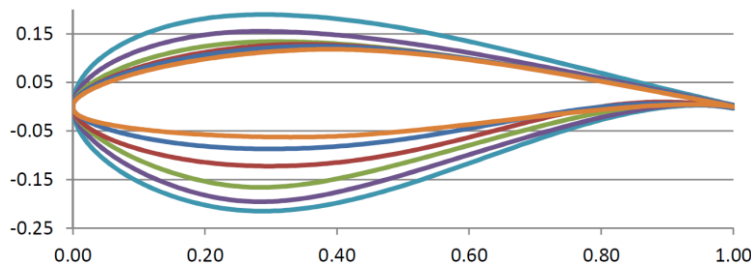


**Abb. 1:** Außenkontur ausgewählter Blattprofiltypen

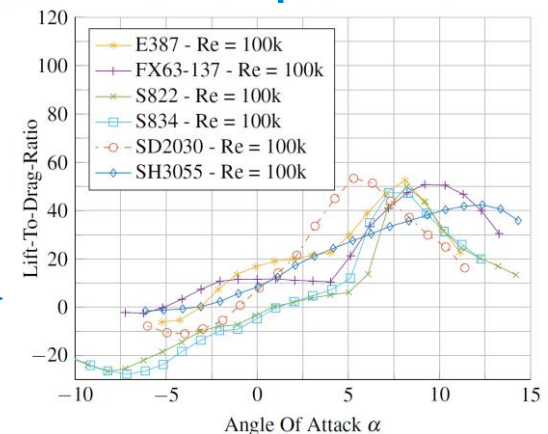


**Abb. 2:** Gleitzahlen ausgewählter Blattprofiltypen in Abhängigkeit vom Anstellwinkel