1.2.7. Description of codes used in the project

WP 1 Integration and evaluation 10 MW Rotor

Code	Description
BOT (ECN)	Stationary axisymmetric BEM code. Unique feature lies in the fact that it is an optimization tool i.e. it automatically optimizes the blade geometry such that maximum energy yield is obtained
Bladmode, Focus and PHATAS (ECN)	FOCUS6 is an integrated modular tool to design wind turbines and wind turbine components as developed by the Wind Turbine Material Center WMC. It includes Phatas which is an aeroelastic tool based on BEM. The unique feature of the BEM modeling in PHATAS lies in the ECN specific engineering models developed and validated in many research projects since the early 90's(e.g. 3D stall models, dynamic stall models, dynamic inflow models, yaw models). Bladmode can be seen as a 'stripped' version of PHATAS, i.e. it is an eigenmode analysis tool in order to check the wind turbine dynamics
HAWC2(DTU)	HAWC is an aeroelastic code based on BEM with DTU specific engineering models where much attention is paid to the implantation of the BEM induction model such that it consistently couples a numerical actuator disc model to the blade element model of the wind turbine rotor. Moreover the momentum approach in BEM can be replaced by a more physical induction model based on an unsteady near (fixed) wake model which takes into account the trailed vorticity of the blades
Cp-Lambda and CP-max(Polimi):	Cp-lambda is a FEM multibody aeroservoelastic simulator, with geometrically exact composite-ready beams, generic topology, based on energy decaying time marching scheme for scaled index-3 formulation. Aerodynamic model based on BEM with a dynamic inflow. CP-Max is then a wind turbine multi-disciplinary design optimization tool based on Cp-Max (see above) and AnBA an Anisotropic beam cross sectional solver
Onewind(Forwind)	One Wind is a a wind turbine simulation tool developed by Fraunhofer IWES, consisting of different parts: OneWind blade for the design of blades and OneWnd Loads for the calculation of loads. Aerodynamic modeling based on BEM with additions.
GE _platform	Industrial loads simulation environment with pre-and postprocessing permitting automatic execution of IEC load cases. BEM-based rotor aerodynamics with multiple corrections, rigid body and modal representation of structural dynamics and controller DLL
FAST (CENER)	FAST is an aeroelastic simulation code based on BEM with specific CENER engineering methods.for e.g. dynamic inflow, tip and hub effects, dynamic stall etc.

FLOWer (Ustutt, IAG)	Flower is a compressible CFD code. A procedure for automated generation of block-structured RANS meshes was developed to reduce turn-around times in a rotor design or analysis process. Steady or time-resolved atmospheric, boundary-layer conditions (data from LES simulations or wind field models) can be fed as inflow condition to the CFD analyses. The atmospheric boundary layer including time-resolved turbulence is propagated in DES mode while the blade boundary-layer is resolved in (u)RANS mode. Transition models (en method and Arnal-Habiballah-Delcourt (AHD) are available. Active trailing-edge flaps and different AFC devices can be simulated with the CFD model. In cooperation with the SWE, USTUTT the CFD chain is coupled to the MBS code SIMPACK for time-accurate aeroelastic simulations which will be available for the AVATAR project. As such the unique features are a high fidelity calculation of all physical interaction effects of the fully meshed complete wind turbine with time-resolved atmospheric inflow, and time-accurate fluid-structure interaction..
GAST (NTUA)	GAST is an aeroelastic code that includes wind and wave simulator modules for external conditions. A choice of BEM (with dynamic stall and inflow corrections) or free wake panel methods is available for the rotor aerodynamic analysis. The wind turbine is modeled through a finite-element multi-body approach, with additional modules for modeling of the control system.
GENUVP (NTUA)	GENUVP is a 3D vortex particle unsteady flow solver that can be used as stand-alone or as the aerodynamic module in GAST. Load calculations in GENUVP are provided either using the ONERA dynamic inflow modeling or by sectional viscous-inviscid flow calculations