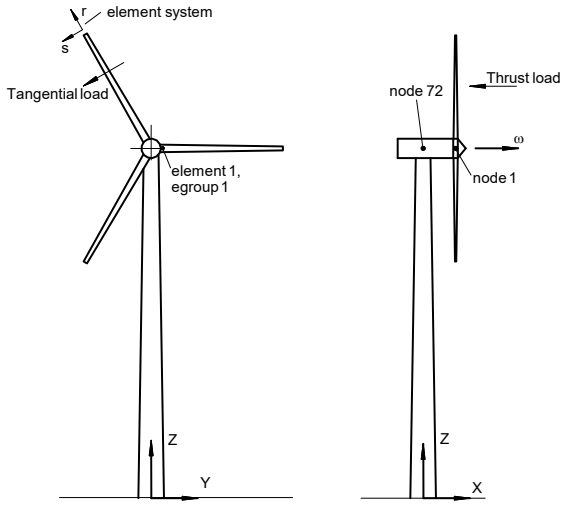
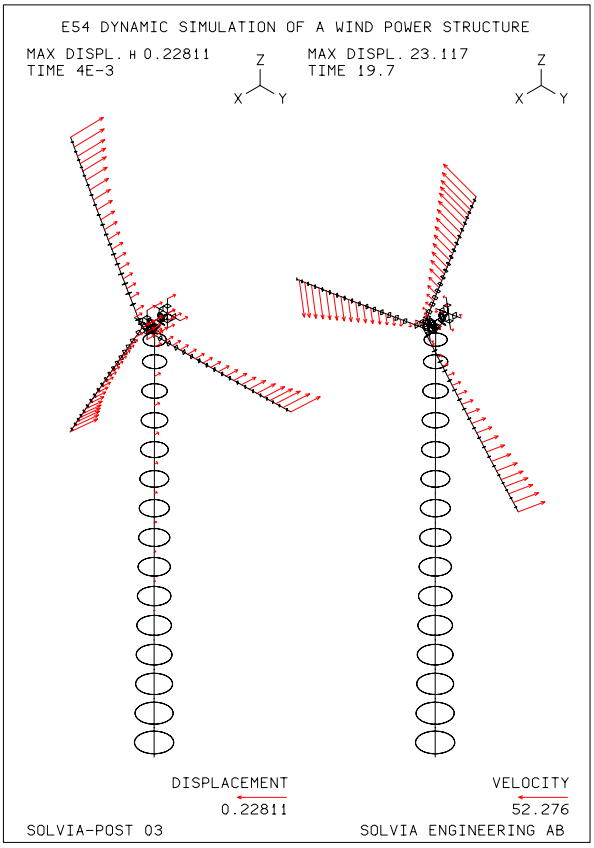
Examples of Capabilities in the SOLVIA® Finite Element System

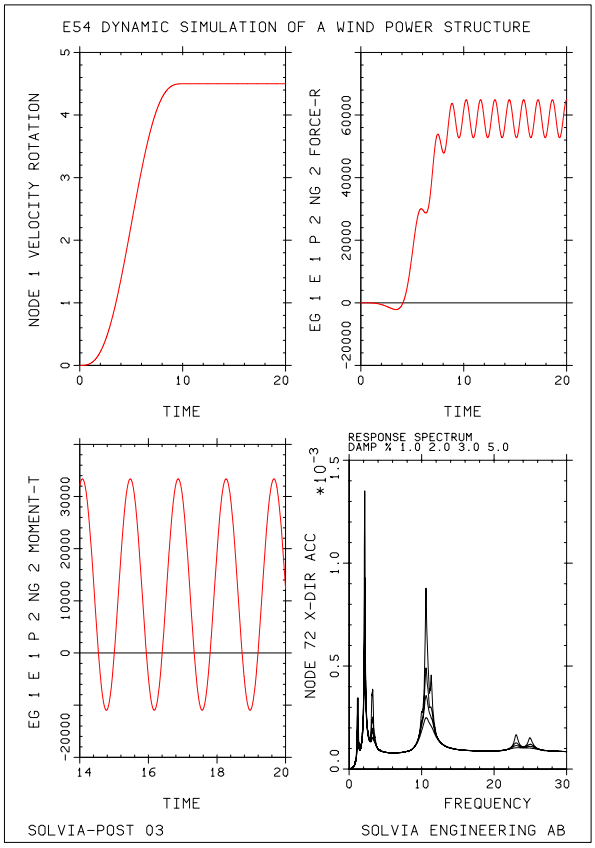
Very Large Rotations of Wind Turbine Rotor Blades



Flexible components under large 3D rotations need frequently to be simulated. Examples are robot arms and rotor blades in wind turbines and helicopters to mention a few application areas. The SOLVIA Nonlinear Verification Manual contains wind turbine simulations where the twisted rotor blades are modeled by co-rotational small strain BEAM elements and total Lagrangian ISOBEAM elements. In particular the BEAM element is very effective and the start-up simulation in SOLVIA shown in the figures below takes only a few minutes on a PC (10000 solution steps simulating 20 seconds). Simulations of nearly 300 revolutions (200000 steps / 400 s) have also been run including analyses of yawing action. SHELL, SOLID and other element types are available in SOLVIA for detailed modeling of rotor blades and other components subjected to large 3D rotations.



Vector plot of displacements at time 4 ms and of the velocities at time 19.7 s.



Rotational velocity of the hub node 1. Rotor blade axial force and bending moment about the t-axis. Axial response spectrum at the top of tower.

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