

**P. Chaviaropoulos, “Development of a State-of-the-art Aeroelastic Simulator for Horizontal Axis Wind Turbines. Part 1: Structural Aspects”, Journal Wind Engineering, Vol 20, No. 6, pp. 405-421, (1996).**

### **Abstract**

The development of a state-of-the-art aeroelastic code for horizontal axis wind turbine simulations is presented in this paper. For convenience the paper is split into two parts. Part 1 is dealing with the theoretical aspects of the method, emphasising on the structural modelling and its related topics. The aerodynamic aspects and application examples are presented in the companion Part 2 paper. Wind turbine dynamics are handled by separating the elastic from the rigid body motion degrees of freedom. Finite element analysis, based on beam elements with twelve degrees of freedom, is used for modelling the dynamics of the complete elastic structure including the tower, the drive train and the blades. Rigid body motion degrees of freedom are treated explicitly through a fully coupled iterative scheme. In both cases the governing equations are derived through Lagrange formulation and solved in the time domain. Numerical recipes and details leading to an efficient time integration scheme are given particular attention. The resulted code has the acronym ALCYONE, from the name of AIOLOS daughter, the ancient god of the winds according to the Greek mythology.

### **Keywords**

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