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DEVELOPMENT OF EFFICIENT MODELS FOR THE STUDY OF COMPLEX ROTATING MACHINES AND OF THE ROTORS-FOUNDATIONS INTERACTION

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The accurate three-dimensional (3D) modelling of the dynamical phenomena characterizing rotating machines plays a fundamental role in rotordynamics and turbomachinery to ensure system stability, to obtain safe operating conditions and to minimize the costs (design, testing installation and maintenance).

A generic rotating machine (see Fig. 1) usually comprises four main structures: rotors, bearings, casings and foundation. In the last decades the research mainly focused on the 2D and 3D analysis of the single previous parts without considering the whole mechanical system [1][2]; however this kind of approach could only lead to partial results. In the last years it has become evident that global 3D models, comprising all the system parts, are required to reach the desired goals in terms of accuracy, stability, safety and costs [3][4]. At the same time high numerical efficiency and memory consumption are needed to get a satisfying compromise between accuracy and numerical efficiency. Currently this is one of the main open problems in rotordynamics and turbomachinery.

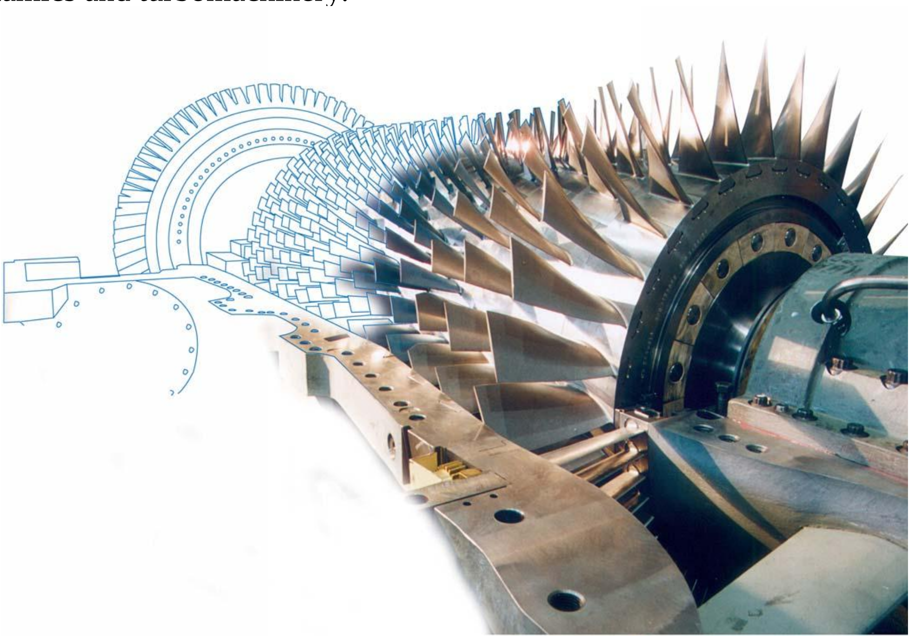

Figure 1. Example of rotating machines

In this work the authors present a global 3D finite element (FE) approach to model complex rotating machines by taking into account all the main parts of the system. The authors aim to obtain some improvements with respect to the state-of-the-art of the discipline especially concerning the achievements of a better compromise between accuracy and numerical efficiency in modelling complex rotating systems comprising one or more turbomachines (turbines, compressors, etc.).

The authors focus also on the feasibility and the performance of different modal reduction techniques to be applied both to the rotor and to the foundation modelling. At the same time sensitivity analyses are performed to study the robustness of such techniques against numerical parameters variation, numerical noise and so on.

The whole model has been developed and validated in cooperation with GE Oil & Gas which provided both the technical documentation and the experimental measurements related to several experimental campaigns performed in the last years on different operating turbomachines composed by turbines, compressors, motors and generators.

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