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TAKING STOCK OF THE RESEARCH ON THE FRICTION DAMPING OF BLADES VIBRATION IN TURBOMACHINERY

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ABSTRACT

The problem of finding the best underplatform damper in order to mitigate the effects of vibrations that occur on blades used in turbomachinery, in aeronautics or in power generation, thus avoiding fatigue failures, is really complex. Essentially for a four-fold order of reasons.

Because the dry friction to the platform / damper contact introduces a non-linearity. Because the geometric shape of the damper (solid) must be controlled through an appropriate pre-optimization in order to avoid undesirable behaviours (lift-off, excessive contact forces, jamming). Because the effectiveness of the damper depends on its interaction with the dynamics of the blade, and therefore on its modal forms which in turn depend on the constraint constituted by the damper itself. Because the blade is an object of complex shape that requires a non-naive approach to be reduced to a low number of degrees of freedom.

A large number of researchers are active on this subject, and publications are regularly published that address individual problems from different visual angles.

Increasing is the number of supporters of "high fidelity", that is the accurate description of the geometry of blades and dampers. The "high fidelity" modelling can also concern the blade-platform contact surfaces up to the smallest geometric detail [1,2,3]. Others believe this may not be the most effective way to solve the problem of finding the best damper and producing its best coupling with the blade. Instead of modelling the contact in detail, some researchers prefer to consider the resulting contact forces [4].

Others face the problem of validating contact models, including micro-slip [5,6], through appropriate experimental techniques on specially designed test-rigs [1,2,5,7]. Reduction methods adapted to the calculation of non-linearity in structures with a high number of degrees of freedom are continuously proposed [8,9,10].

Some research groups study the influence of many geometric blade design parameters. However, when this relatively large number of parameters are associated with a "high fidelity" approach, the problem quickly becomes intractable, especially if non-linear iterative

calculations are to be performed. To overcome this difficulty, the use of surrogate models is also proposed [11].

The aim of the mini-symposium is to bring together the main research groups active in the different continents in order to examine these issues in greater detail and compare the competing methods.

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