Detection and simulation of viscoplastic instabilities in rotating disks (rotor integrity)

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- Mechanical behaviour of INCO718
- Modeling elastoplasticity behaviour
- Local fracture criterion
- Production control

Abstract:

During the design of turboshaft engines, regulation rules impose on manufacturers to demonstrate the integrity of rotating parts with over-speed experiments: parts should not burst under mechanical and thermal loads below the rotation speed imposed by the regulation. This requirement guarantees a minimal safety margin depending on the operating conditions.

The goal of the Ph.D is to determine failure criterion by viscoplastic instabilities on rotating disks. Elastoviscoplasticity properties of super-alloys have to be taken into account under temperatures that range from 20 to 500°C. These laws have to be integrated into finite element simulations of plastic deformations under extreme rotational speed conditions.

The approach consists on, first, complete the experimental basis in order to identify the material parameters for INCO718; second, define a local fracture criterion which leads to the fracture of three super-alloys (INCO718 and Udimet 720) under temperature and triaxial loading similar to those on rotors, and finally, establish a verification procedure of the criterion than can be directly applied in production control.