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A modelling approach for contact interfaces in nonlinear dynamics.

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Turbomachinery components often exhibit a nonlinear behaviour due to the localised nonlinearities introduced by friction interfaces [1]. The influence of the contact interfaces on the vibration response cannot be neglected, as it can lead to significant dissipation and frequency shift of the dynamic response of the mechanical components. Various modelling approaches have been used at the Imperial College London Vibration UTC, mainly characterised by a discretisation of the contact interface using a set of node-to-node friction contact elements [2]. An improved modelling approach is proposed here, in which the contact interface is discretised using zero-thickness finite elements [3].

The contact physics includes the micromechanical interaction at the asperity level by employing an advanced microslip law which accounts for coupled normal-tangential displacements. A strategy is proposed to link the physical parameters of the contact surfaces, such as roughness, hardness and Youngs modulus to the microslip law used for the zero thickness elements. The flexibility of this approach allows the adoption of different contact laws with any level of detail, depending of the requirements of the application. The modelling approach is illustrated with a realistic test case, and its predictive performance are evaluated highlighting the advantage of this approach compared to more simplistic models.

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