

Three-dimensional finite element analysis of loosening of threaded fasteners

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Due to light weight design, self-loosening has become one of the most widespread origins of failure of bolted joints submitted to alternate transverse (perpendicular to the bolt axis) loading. Unlike fatigue, there is no safety criterion used in design to prevent self-loosening. In order to fill this gap, it is essential to first identify the effect of each threaded connection parameters (tension, friction, material, geometry ...) on the loosening strength. Simplified tests have been conducted for various configurations. To understand the experimental observations, a numerical analysis, based on a three-dimensional finite element model close to the test setup, has been carried out. Results of the quasi-static simulation show good agreement to those obtained experimentally. New computational results like local contact states under screw head and on threads, and contact pressure on the same surfaces help to better describe self-loosening process.

Keywords: Finite element analysis, self-loosening, threaded fasteners, reliability, joint failures, local contact state