NAFEMS UK Regional Conference 2018 - Abstract Submission

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Please identify the event for which your submitting?	NAFEMS UK Conference 2018
Will you be the presenting author?	Yes
Presentation Title	Bolt Preload Modeling Methods
Relevant Themes / Keywords	bolt, preload, pretension, bolted joints, contact, initial strain, cut section, beam, bar

Abstract (plain text)	Preloaded bolts are used in finite element analysis to model the behavior of two or more parts being held together while undergoing mechanical, thermal or other loading conditions. Such a modeling scenario typically requires the bolts to be preloaded to a specified value and a set of contact regions to be established between the parts held together by the bolt. This is done by either specifying a load or a bolt shortening. The resulting preload can be identified by studying the internal forces within the bolt shaft or by the contact forces between the various parts that are held together. The bolt preloading approach that currently exists in various commercial solvers involves defining beams or solid elements that form the bolt shaft and specifying a location where the solver cuts the model perpendicular to the bolt axial direction. The requested load or a shortening is applied axially on either side of the cut in opposite directions while reducing the axial stiffness along the bolt axial direction. This causes the part to shorten whereby each cut plane penetrates the other resulting in a tension that equals the requested preload. This method of preloading bolts is well-known to finite element users and has a high degree of accuracy and reliability. An alternate, novel approach to preload bolts is presented here wherein the preload or shortening is applied as an initial strain along the bolt. Here, the user selects a set of elements that form the bolt shaft along with a bolt axial direction. Numerically, the user defined preload is applied as an initial strain on the selected elements and does not require the shaft to be cut. The resulting initial strain may need to be iterated upon until the internal forces in the bolt elements match the user requested preload. Comparison of the cut approach and the initial strain approach results will be presented. Realistic model showing application of the initial strain method will also be presented.
Please enter any additional comments or messages here	This abstract talks about a novel method for preloading bolts in finite element solvers. The methodology is new and quite different from existing methods where the bolt has to be topologically cut.
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