



Providing Alternate Solutions to Engineering Problems

Properly applying boundary conditions is critical to the validity of any finite element solution. An example of this is the modeling of a pinned connection between two or more components. The strength of the pinned connection is often an important part of a design. Evaluating a pinned connection in a finite element model is possible using contact but can be time consuming and expensive due to the level of detail required and the nonlinearity introduced. Engineers often look to approximate methods that save time but can come at the expense of solution accuracy.

Engineers at Sikorsky Aircraft were comparing the finite element result of a particular lateral load distribution method with a closed form solution that they have been using for many years. They were finding that the results of the finite element model were showing a higher stress concentration around the hole than that of their traditional approach. Although the finite element model results were conservative and useful for most applications, the extra measure of conservatism could not be tolerated in an industry where weight savings is critical. There are numerous pinned connections in helicopter assemblies and confidence in the modeling approach is absolutely necessary.

Sikorsky turned to the engineers at CAE Associates for assistance with the modeling approach. Using the Sikorsky test standard,

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—Antonio Portelinha,
Sikorsky Aircraft

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CAE Associates illustrated in detail the root cause of the stress concentration factor increase and showed Sikorsky how to implement the load in a way that better emulated their traditional solution. A detailed model that included pin geometry and contact was used as the standard to which the closed form solution and the approximate methods were compared. engineers could decide which method best met their standard. In the process CAE Associates provided an alternate method that produced a result very similar to modeling the pin-to-hole contact, but at a fraction of the computational cost. At the conclusion of the project, CAE Associates was invited to present the findings to the Sikorsky analysis community.

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