checkSTRESS

EXAMPLE 1 - Using Expansion Loops

DATA: An 8" NB Schedule 80 pipe (see Fig. 1A) connects two equipment at nodes 10 and 30 with an offset of 4' (i.e., equal to distance between nodes 20 and 30). The pipe, made of A53 Grade A carbon steel, is heated to 300° F. This problem illustrates the use of expansion loops to reduce thermal stresses.
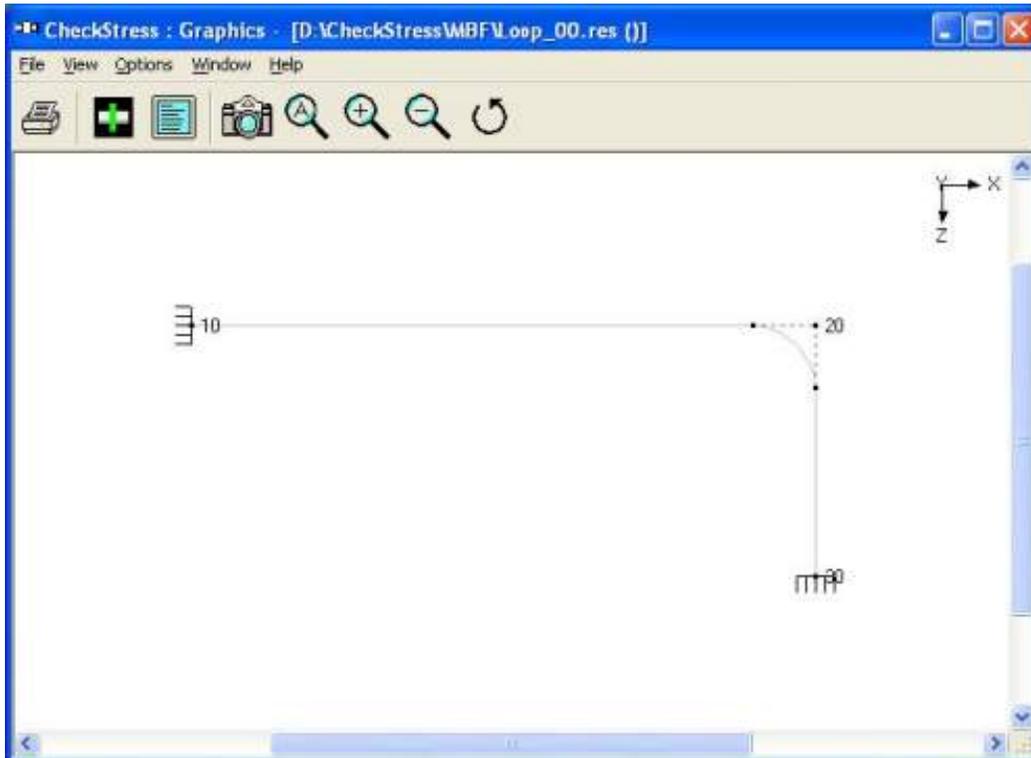
Figure 1A - Layout

Pipe between nodes 10 and 20 grows thermally to the right towards node 20, while pipe between nodes 30 and 20 grows up towards node 20, as illustrated in Fig. 1B.
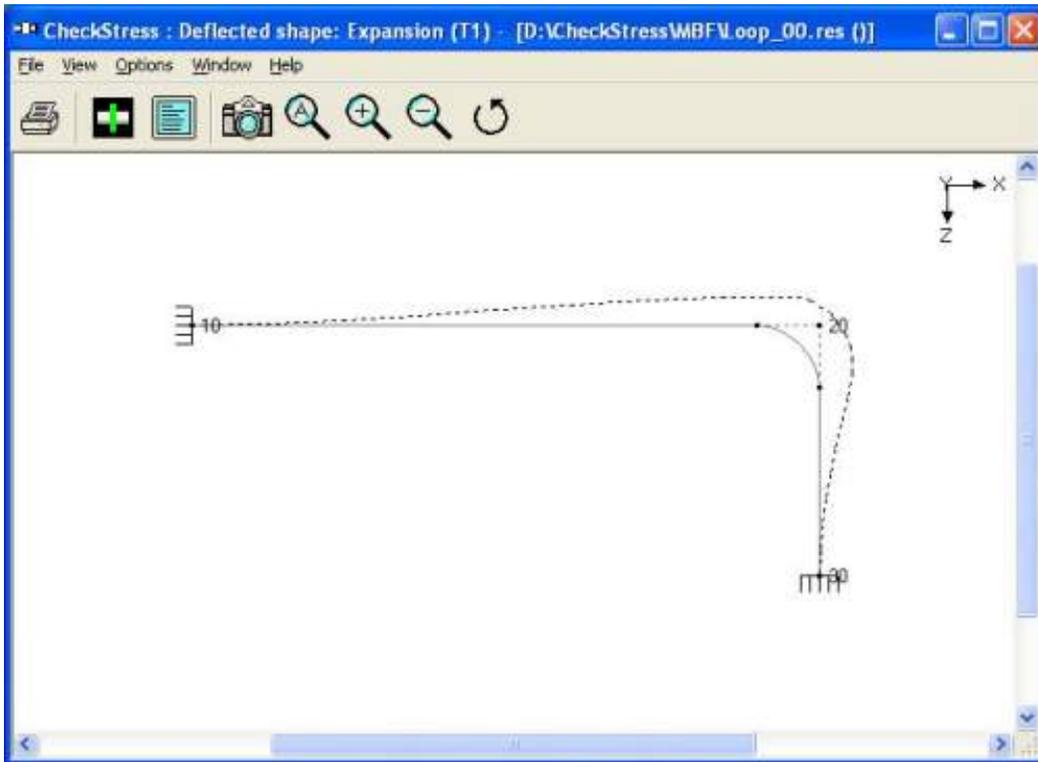
Figure 1B - Thermal Deflection

This thermal deformation generates large thermal stresses (orange and red zones) in the bend at node 20 and at anchor node 30, as shown in Fig. 1C.
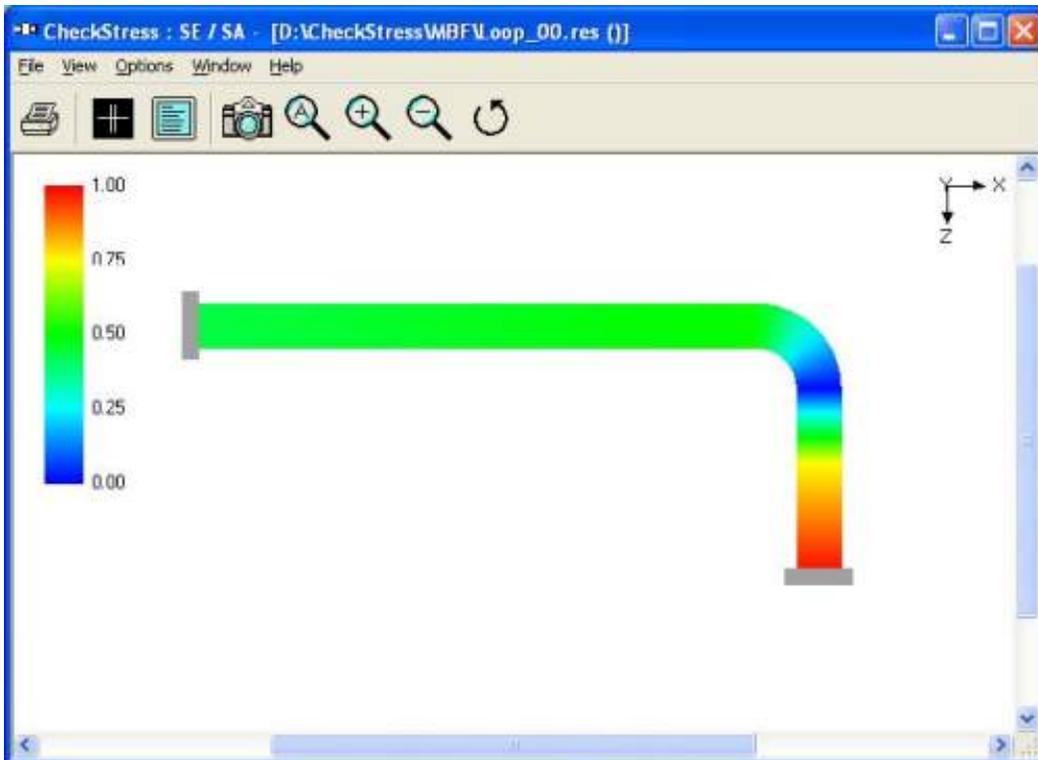
Figure 1C - Non code-compliant (notice the reds)

Now, as a designer, when you use checkSTRESS, you know this layout will be sent back to you by the Stress dept. with suggested rerouting. If you had known beforehand what the engineer discovers, you could have done the rerouting as shown in Fig.1D.
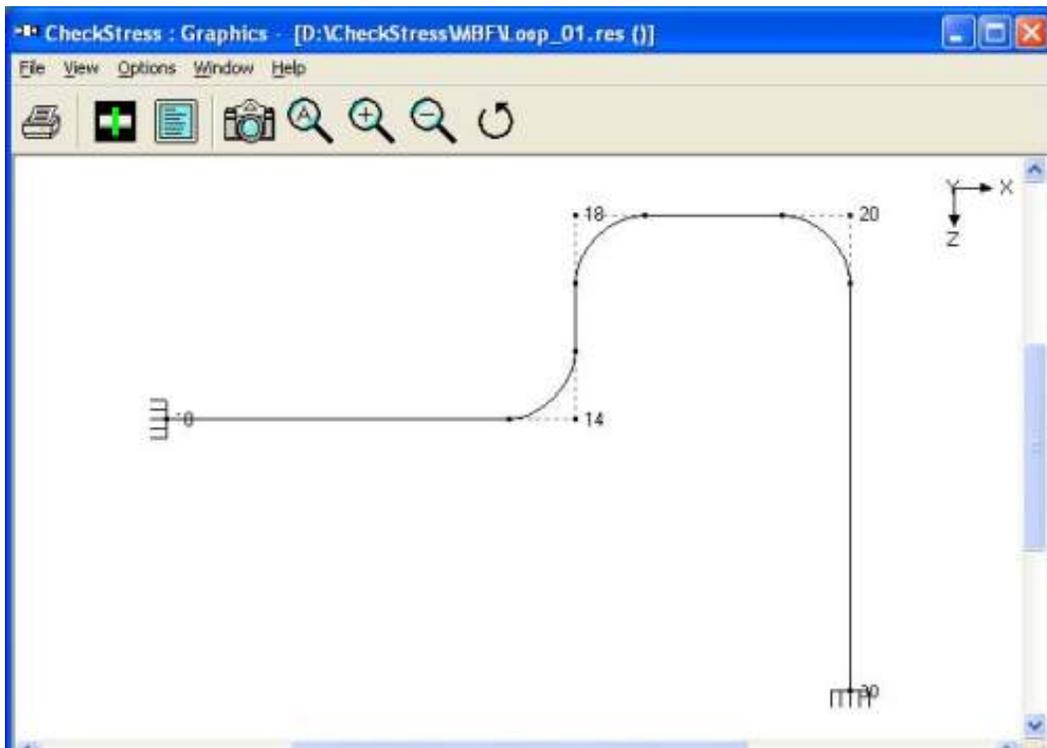
Figure 1D - Avoiding the "back and forth" by rerouting beforehand

Fig. 1D shows a revised layout with a loop, introducing two additional bends at nodes 14 and 18, thereby making the layout more flexible. So, thermal growth of X-directional pipes between nodes 10 and 14 and then between 18 and 20 as well as the growth of Z-directional pipe between nodes 30 and 20 are absorbed by the 3 bends at nodes 14, 18 and 20. The corresponding stress contour plots for thermal and sustained load cases are shown in Fig.1E and Fig. 1F, confirming code compliance. Now, the designer sends this code-compliant model file to the engineer for further detailed analysis, saving his/her valuable time and the engineer's as well.
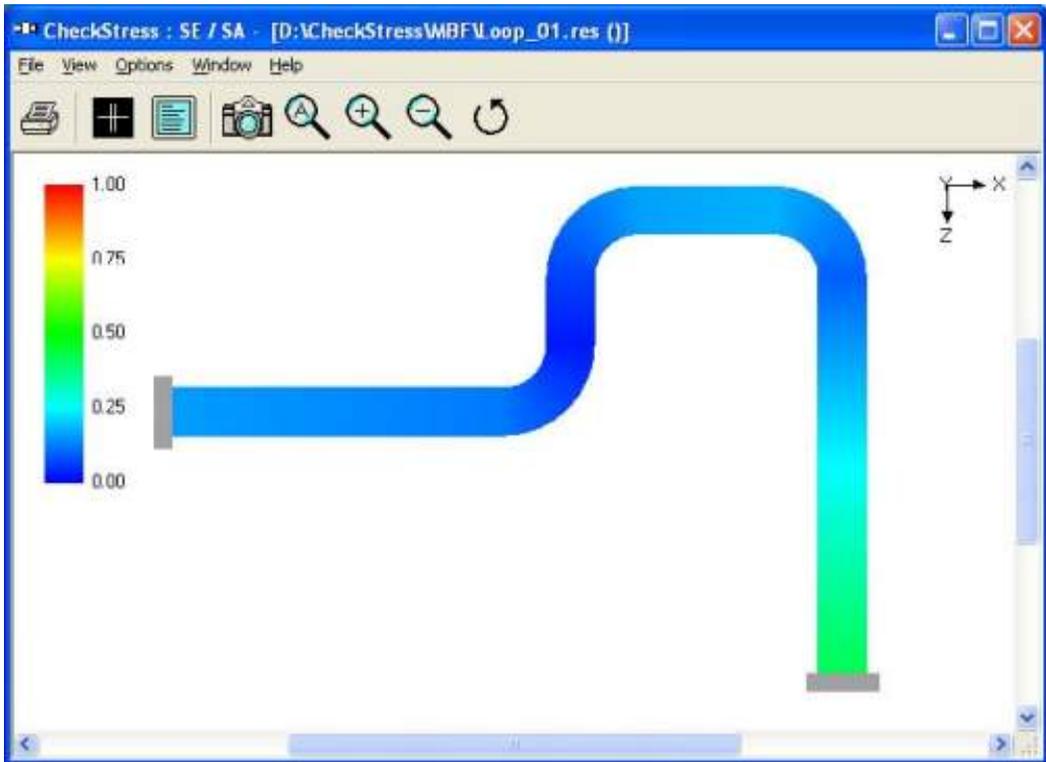
Figure 1E - (Code compliant thermal case)
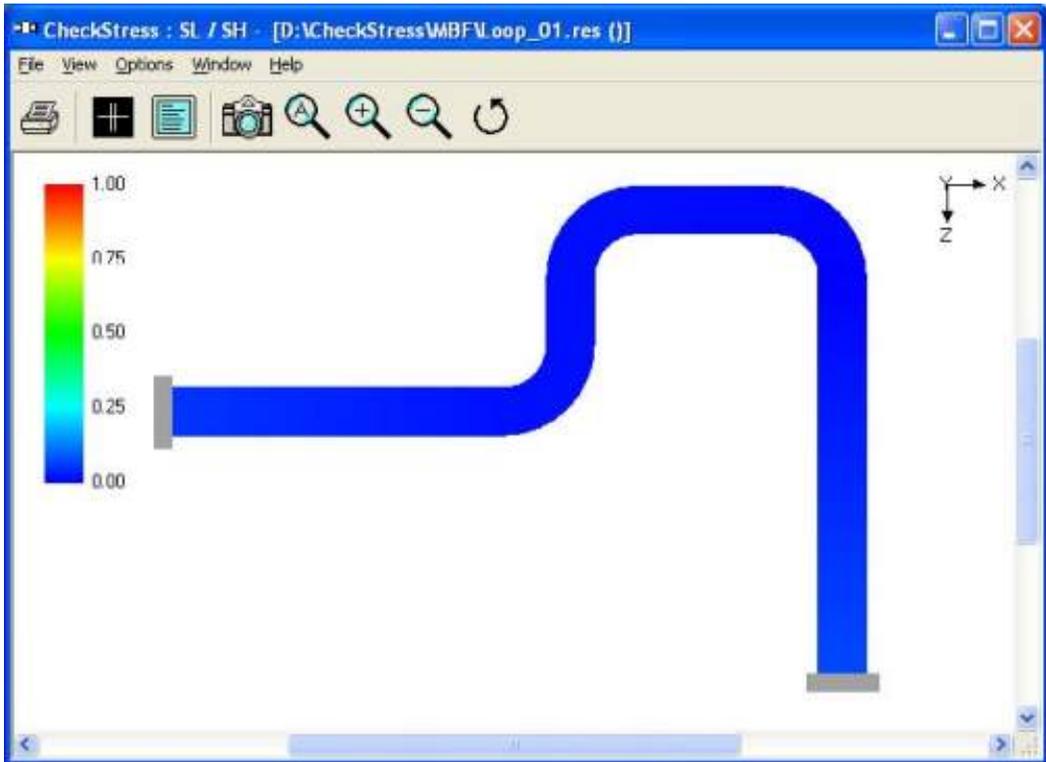
Figure 1F - (Code-compliant sustained case)