

Conjugate Heat Transfer In Fully Developed Laminar Pipe Flow And Thermally Induced Stresses

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Summary

Thermal stresses developed in pipes due to conjugate heat transfer are important in engineering applications. In the present study, fully developed laminar flow through a pipe is considered. Uniform heat flux from the external surface of the pipe is introduced. The thermal stresses developed due to conjugate heating are analyzed. The governing flow and energy equations are solved numerically using a control volume approach. Thermal stresses due to temperature gradient are also computed. Various fluids and thermal conductivity ratios are taken into account. This helps to examine the effect of the thermal properties of fluid and pipe on the resulting stresses. It is found that the low Prandtl number and low thermal conductivity ratios result in almost uniform radial temperatures and low radial effective stresses. (C) 2000 Elsevier Science S.A. All rights reserved.

References:

1. ARNAS OA, 1985, J HEAT TRANS-T ASME, V107, P334
2. BAROZZI GS, 1985, J HEAT TRANSFER, V107, P77
3. CHU SC, 1965, APPL SCI RES A, V14, P379
4. FAUPLE JH, 1981, FISHER ENG DESIGN SY
5. GHARIBAN N, 1995, J HEAT TRANS-T ASME, V117, P289
6. KANDIL A, 1995, INT J MECH SCI, V37, P721
7. KANDIL A, 1996, INT J MECH SCI, V38, P1319
8. LIN LC, 1997, INT J HEAT MASS TRAN, V40, P4393
9. LUIKOV AV, 1971, INT J HEAT MASS TRAN, V14, P1047
10. MOSCHANDREOU T, 1997, INT J HEAT MASS TRAN, V40, P2461

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<http://www.kfupm.edu.sa>

11. NAGHDI AK, 1996, J THERM STRESSES, V19, P341
12. OBATA Y, 1994, J THERM STRESSES, V17, P471
13. PARAKASH C, 1985, J HEAT TRANSFER, V107, P84
14. RUSSO EP, 1995, ASME JSME THERM ENG, V1, P59
15. SHADLEY JR, 1982, J PRESSURE VESSEL TE, V104, P193
16. SHOME B, 1995, INT J HEAT MASS TRAN, V38, P1945
17. SINHA R, 1978, J I ENG MECH ENG DIV, V59, P131
18. TAMMA KK, 1987, COMPUT METHOD APPL M, V64, P415
19. TANAKA K, 1996, COMPUT METHOD APPL M, V135, P369

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