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On Laminar and Turbulent Free Convection in Thin Spherical Shells[1] YURI FELDMAN, TIM COLONIUS, California Institute of Technology, Pasadena, CA, USA, 91125 — Laminar and turbulent free convection flow inside thin spherical shells with isothermal cold and hot boundaries and internal/external radius ratios in the range of $0.85 \leq r_i/r_o \leq 0.95$ is numerically investigated. The accuracy of the results has been verified by grid independence analysis and DNS-LES comparisons of the flow characteristics for the typical cases. The functional *Nu-Ra* dependency is extensively investigated for the range of $10^3 \leq \mathrm{Ra} \leq 10^{10}$ including laminar, transitional and fully turbulent flow regimes. For thin shells, we observe considerable deviations from the existing engineering correlations. The deviations tend to increase for transitional and fully turbulent flows. A new correlation for *Nu-Ra* dependency is proposed and favorably verified by independently obtained experimental end numerical results. The influence of non-uniform temperature distribution along the shell boundaries on the overall heat flux rate is also discussed.

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