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Heat Transfer Process Parameter Optimization in SI/Ge Using TAGUCHI Method

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Abstract : With the advent of new nanometer process technologies, it is possible to integrate billion transistors on a single substrate. When more and more functionality included there is the possibility of multi-million transistors switching simultaneously consuming more power and dissipating more power along with more leakage of current into the substrate of porous silicon or germanium material. These results in substrate heating and thermal noise generation coupled to signals of interest. The heating process is represented by coupled nonlinear partial differential equations in porous silicon and germanium. By identifying heat sources and heat fluxes may results in designing of ultra-low power circuits. The PDEs are solved by finite difference scheme assuming that boundary layer equations in porous silicon and germanium. Local heat fluxes along the vertical isothermal surface immersed in porous SI/Ge are considered. The parameters considered for optimization are thermal diffusivity, thermal expansion coefficient, thermal diffusion ratio, permeability, specific heat at constant temperatures, Rayleigh number, amplitude of wavy surface, mass expansion coefficient. The diffusion of heat was caused by the concentration gradient. Thermal physical properties are homogeneous and isotropic. By using L8, TAGUCHI method the parameters are optimized.

Keywords : heat transfer, pde, taguchi optimization, SI/Ge
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