Steady thermal conduction in solids \[\text{[TCO1]}\]

configuration variables
space: primal complex
(time even variables)

g_x = \partial_x T
\quad g_y = \partial_y T
\quad g_z = \partial_z T

source variables
space: dual complex
(time odd variables)

\sigma_u = \partial_x q_x + \partial_y q_y + \partial_z q_z

dissipative constitutive equation

\begin{align*}
qu_x \text{ law} &= -\lambda g_x \\
qu_y \text{ law} &= -\lambda g_y \\
qu_z \text{ law} &= -\lambda g_z \\
\end{align*}

Fundamental equation

Poisson

\[-\lambda \left( \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} + \frac{\partial^2 T}{\partial z^2} \right) = \sigma_u\]

\(T\) temperature

\(g\) temperature gradient

\(\sigma_u\) heat source

\(q\) heat current density

\(\lambda\) thermal conductivity

TCO1-7: http://discretephysics.dicar.units.it