Steady thermal conduction

algebraic formulation, global variables

configuration variables
space: primal complex
time: dual complex
(time even variables)

source variables
space: dual complex
time: primal complex
(time odd variables)

\[
\begin{align*}
T_h &= \sum_k g_{ak} T_k \\
G_\alpha &= \sum \tilde{d}_{ha} \Phi_\alpha = \sigma_h
\end{align*}
\]

constitutive equation

\[
\Phi_\alpha = -\lambda \frac{\tilde{s}_a}{l_a} G_\alpha
\]

fundamental equation:

\[
Poisson: -\lambda \sum_k L_{hk} T_k = \sigma_h
\]

Voronoi prism

Delaunay prism

\[
L_{hk} \text{ discrete Laplacian}
\]

\[
T_h \text{ temperature associated with the point } \mathbf{p}_h
\]

\[
G_\alpha \text{ temperature difference associated with } \mathbf{I}_a
\]

\[
\sigma_h \text{ heat production rate associated with the dual cell } \mathbf{v}_h
\]

\[
\Phi_\alpha \text{ heat current associated with the dual cell } \mathbf{s}_a
\]

\[
\lambda \text{ thermal conductivity}
\]

TCO4-5: http://discretephysics.dicar.units.it