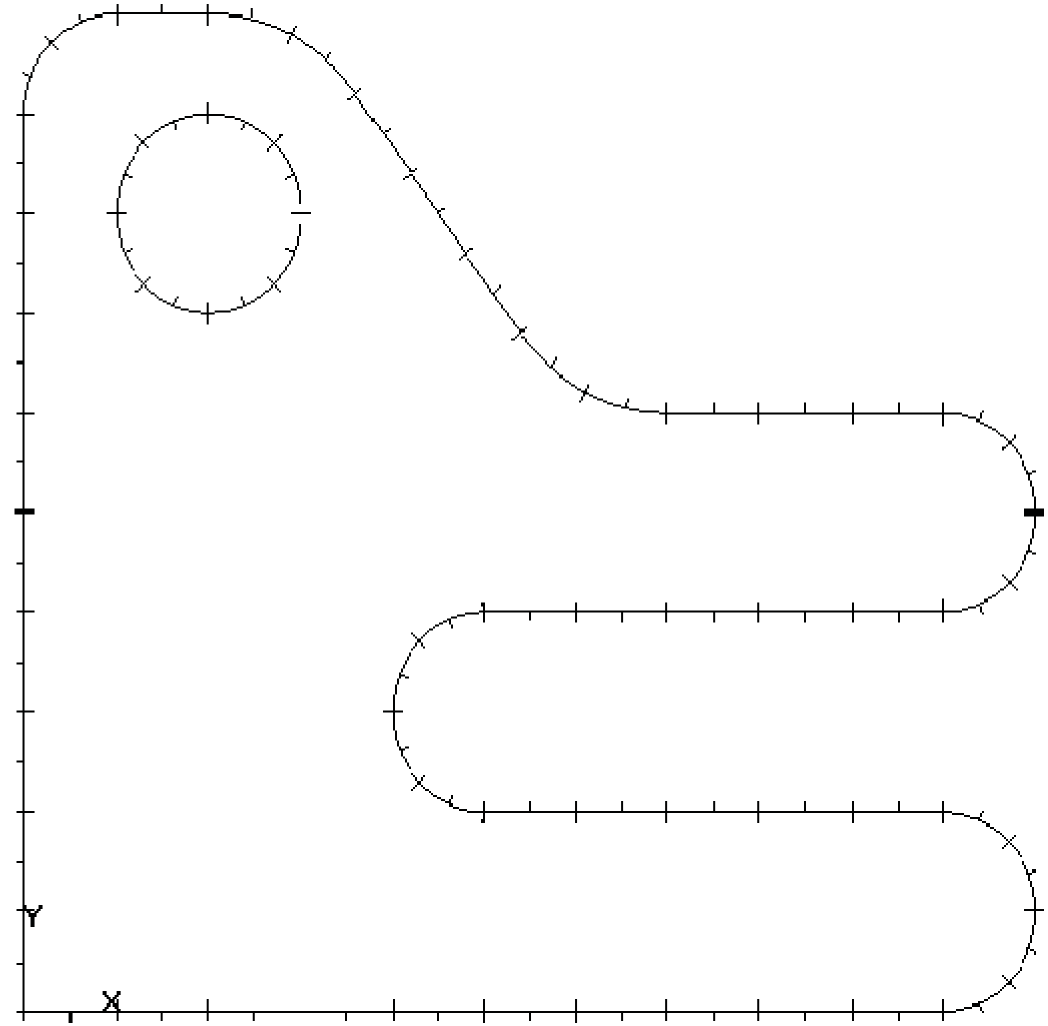
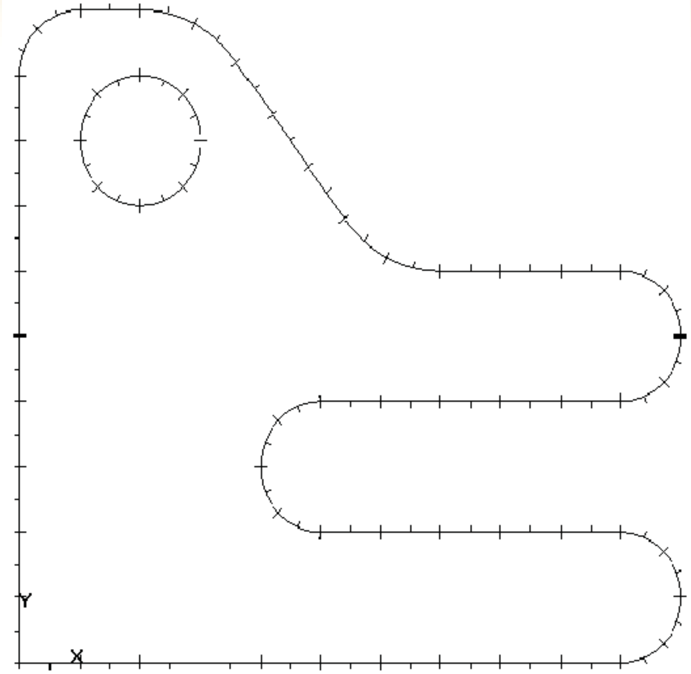
BEM Basics

- With BEASY you only need to define elements on the BOUNDARY or SURFACE

- BOUNDARY ELEMENTS



BEM Basics



Green's Theorem

$$\int_{\Omega} \nabla \cdot \mathrm{F}\, d\Omega = \int_{\Gamma} \mathrm{F} \cdot \mathrm{n}\, d\Gamma$$

Virtual Work

$$\int_{\Omega} \left(u^{*} \nabla^{2} u - u \nabla^{2} u^{*} \right) d\Omega = \int_{\Gamma} \left(u^{*} \nabla u - u \nabla u^{*} \right) \cdot \mathrm{n}\, d\Gamma$$

$$u(p) = \int_{\Gamma} u^{*} q\, d\Gamma \; - \; \int_{\Gamma} q^{*} u\, d\Gamma$$

BEM Basics

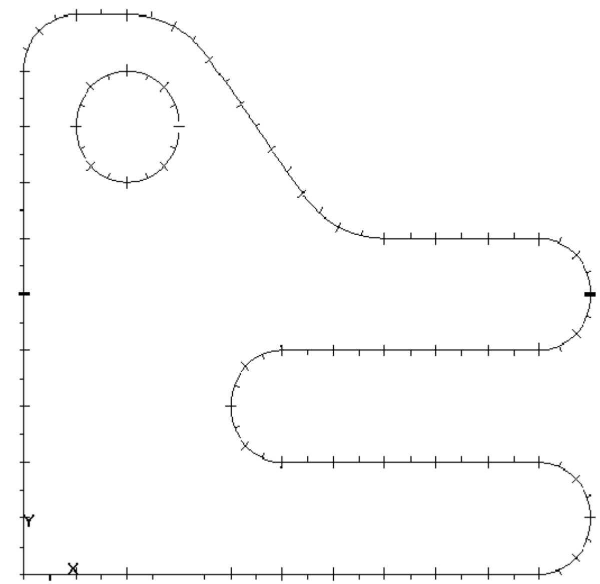
$$c(p)u(p) = \int_\Gamma u^* q \, d\Gamma - \int_\Gamma q^* u \, d\Gamma$$

or

$$c(p)u(p) + \int_\Gamma q^* u \, d\Gamma = \int_\Gamma u^* q \, d\Gamma$$

Boundary Integral Equation

$$c(p) = \begin{cases} 1, & \text{in domain} \\ \frac{1}{2}, & \text{on smooth boundary} \\ \frac{\theta}{4\pi}, & \text{on nonsmooth bounday } (\theta \text{ is the solid angle}) \\ 0, & \text{out side domain} \end{cases}$$



BEM Basics

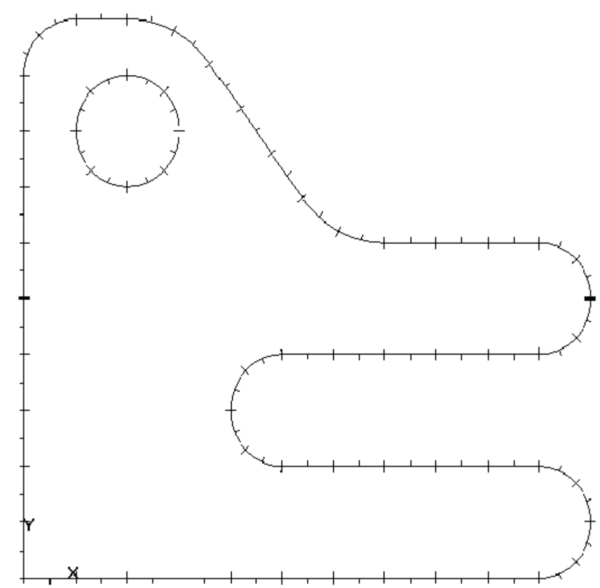
Boundary Element Method

$$c(p)u(p) + \sum_e \int_\Gamma q^* u \, d\Gamma = \sum_e \int_\Gamma u^* q \, d\Gamma$$

$$c(p)u(p) + \sum_e \int_\Gamma q^* \, N^T \, d\Gamma \, u = \sum_e \int_\Gamma u^* \, N^T \, d\Gamma \, q$$

$$0.5u_1 + h_{11}u_1 + h_{12}u_2 + \cdots\cdots = g_{11}q_1 + g_{12}q_2 + \cdots\cdots$$

$$\begin{bmatrix} 0.5 + h_{11}, h_{12}, h_{13}, \cdots\cdots \\ h_{12}, 0.5 + h_{22}, h_{23}, \cdots\cdots \\ h_{31}, h_{32}, 0.5 + h_{33}, \cdots\cdots \\ \vdots \\ \vdots \end{bmatrix} \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ \vdots \\ \vdots \end{Bmatrix} = \begin{bmatrix} g_{11} & g_{12} & g_{13} & \cdots \\ g_{21} & g_{22} & g_{23} & \cdots \\ g_{31} & g_{32} & g_{33} & \cdots \\ \vdots & & & \\ \vdots & & & \end{bmatrix} \begin{Bmatrix} q_1 \\ q_2 \\ q_3 \\ \vdots \\ \vdots \end{Bmatrix}$$



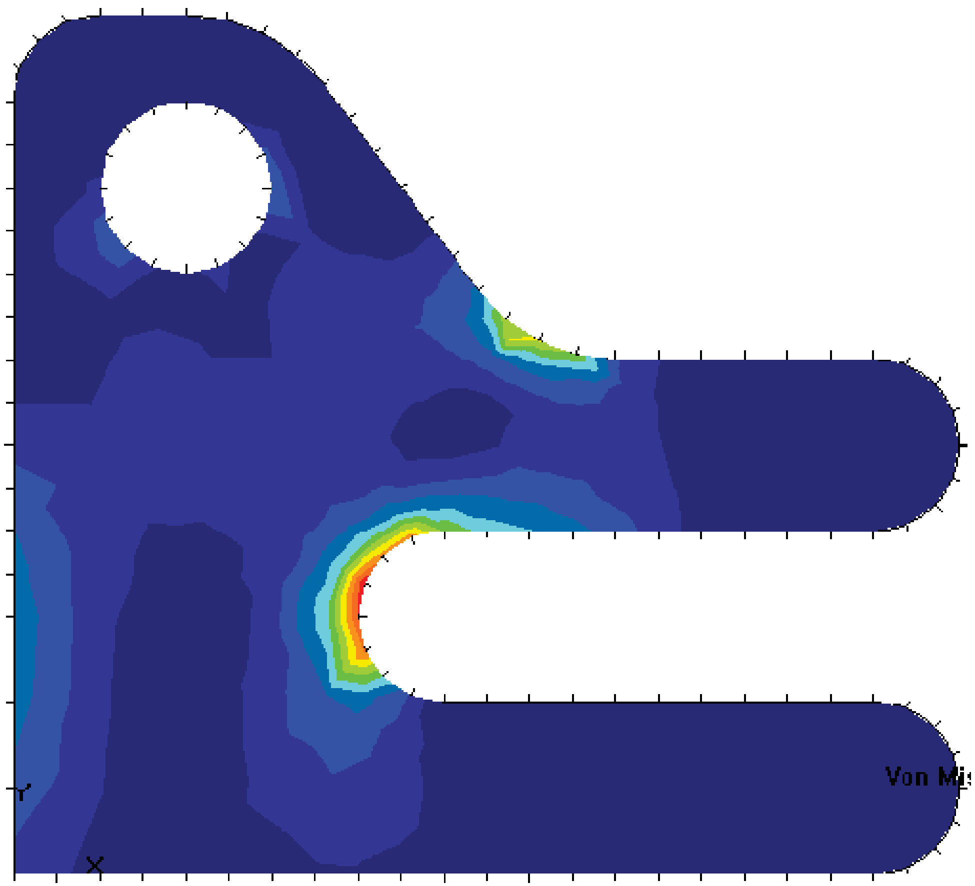
[H]{u}=[G]{q}

[A]{x}=[B]{y}

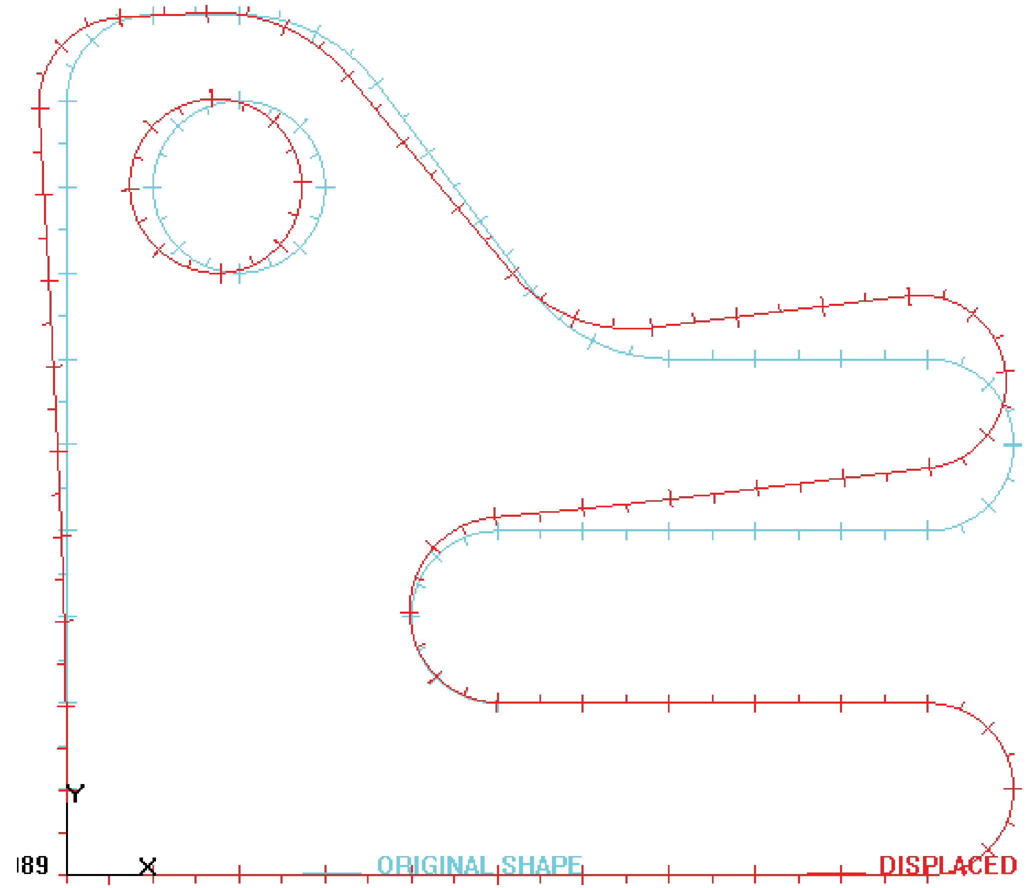
Apply BC

[A]{x}={b}

BEASY Results

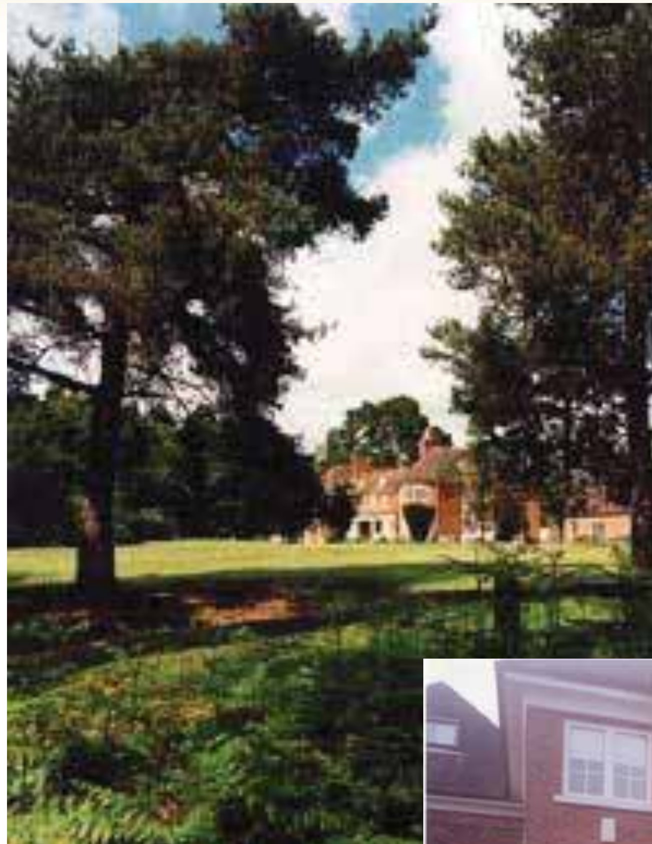


Stress Distribution



Deformed Shape

BEASY Home Ashurst Lodge



BEASY Applications Areas