Introduction

Sensitivity analysis requires perturbed meshes (meshes with a small perturbation of the design variables). These meshes can be created by using the boundary node approach.

Figure 1: Mesh with positive perturbation

Relatively large perturbations of boundary elements can occur which cause inaccurate finite difference approximations and consequently inaccurate design sensitivities.

Objective

Accuracy improvement of semi-analytical design sensitivities for shape design variables.

Method

Using Laplacian smoothing the interior nodes of the mesh can be distributed more equally.

Figure 2: Laplacian smoothing: Relocation of all interior nodes of the mesh to the average position of adjacent nodes

Results

Figure 3: Mesh with positive perturbation after Laplacian smoothing

Figure 4: First order design sensitivities of the tip displacement of the strip.

Conclusions

- Significant accuracy improvement of semi-analytical design sensitivities
- Small increase in computation time
- Simple implementation
- Implementation independent of preprocessor

References