

# NEiNastran *for Windows*

## NEiOptimization (Design Optimization Analysis)

### Overview

The NEiOptimization software (HEEDS – Hierarchical Evolutionary Engineering Design System) by Red Cedar Technology is a package for design automation. It performs process integration, automated design of experiments and optimization, sensitivity studies, reliability and robustness assessments on engineered products and processes. The software can be used to improve any engineering system (structural, thermal, fluid, acoustic, electrical). In structural design applications, for example, it can evolve designs that simultaneously satisfy objectives and meet constraints targets for durability, crashworthiness, stiffness, noise and vibration, mass and cost, manufacturability and reliability.

### Capabilities:

#### Process Integration and Automation:

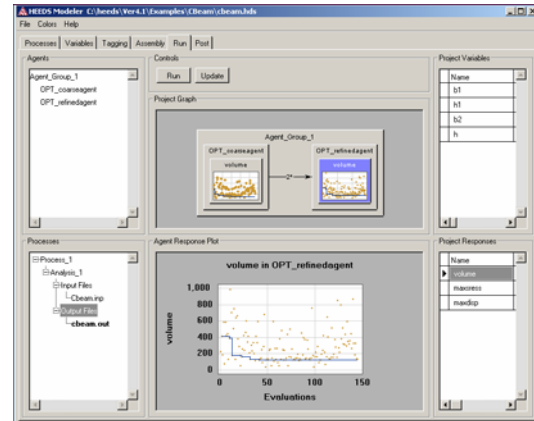
- Automated Sequential and Coupled execution of Multiple Simulation and Analysis Tools
- Integration and Sharing of Data among Separate Simulations
- Direct Interface for Data Extraction from Common CAE Tools
- Supports Parallel Processing on Heterogeneous Networks, Clusters, and Multiprocessors

#### Topology Optimization:

- Minimizes compliance of structures
- Identifies efficient load path for mass/volume target
- Supports 2D Planar and 3D Solid finite element models
  - Interfaces to ABAQUS and HEEDS\_FEA finite element codes

#### Quality Design Tools:

- Reliability and robustness assessment
- Structured sampling
- Random (Monte Carlo) sampling
- Post-processing: standard deviation, scatter plots

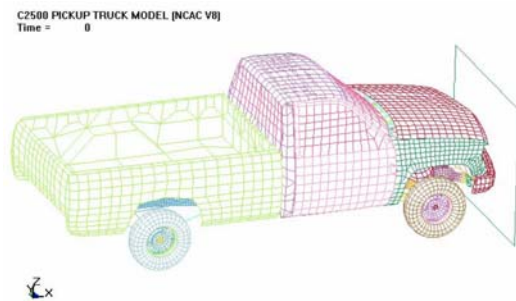


### Parameter Optimization Methods and Strategies:

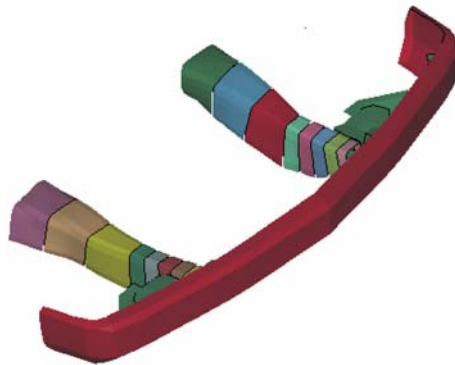
- Automated adaptive search that uses multiple search tools concurrently
- Global Search Methods
  - Genetic Algorithm (Hybrid, Hierarchical, Heterogeneous, Adaptive, Mixed-Variable)
  - Advanced Proprietary Evolutionary Search Algorithm
  - Simulated Annealing
- Local Search Methods
  - Nonlinear Sequential Programming
- Surrogate-Based Methods
- User-Defined Methods via Application Programming Interface (API)

### Unique Features and Capabilities:

- Multiple agent design search strategies
  - Cooperative Independent Agent (CIA) search
  - Shared Discovery and Co-Evolution of Optimal Designs
- Hierarchical decomposition strategies
  - Component Optimization within a System Environment (COMPOSE). See Figures 1 and 2 with a crash model used to demonstrate COMPOSE.
  - Decomposition with respect to spatial/time domain, design space, discipline



**Figure 1. System Level Model (pickup truck)**



**Figure 2. Reduced Subsystem Level Model**

#### **Design of Experiments:**

- Full factorial designs (two-level and three-level)
- Fractional factorial designs (two-level and three-level)
- Taguchi orthogonal arrays
- Plackett-Burman designs
- Latin Hypercubes
- Central composite designs
- D-Optimal designs
- User-Defined arrays
- User-Defined response data
- Post-processing: ANOVA, main effects plots, interaction effects plots, Pareto charts, normal plots, response surface searching

#### **Response Surfaces:**

- Linear
- Quadratic
- Multivariate adaptive regression splines

#### **Solution Monitoring:**

- Process control and run-time adjustment capability
- Real-time solution monitoring with user-controlled graphs and tables
- User-specified termination criteria

#### **Graphical User Interface:**

- Intuitive graphical
  - Pre-processing
  - Run-time monitoring
  - Post-processing
- Simplified coupling of simulation and analysis tools
- Guided problem set-up procedure
- Facilitates detailed and global view of problem statement
- Platform independent

#### **Supported Platforms:**

- Windows (98, NT, XP, 2000)
- Linux
- SUN
- HP

#### **Unparalleled support:**

- Leader in outstanding customer support
- Onsite and offsite training courses taught by experienced professional engineers
- Phone and email support staffed by a team of FEA specialists
- Optional consulting services available

**Noran Engineering, Inc** is aggressively focused on commitment to the customer. Detailed documentation, customized on-site training, and comprehensive technical support ensures that you will see immediate return on your investment.

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