

Overview

NAGFORM is a knowledge based software program for designing forging sequence of cold, warm and hot forged parts. It allows the user to capture manufacturing knowledge and use it to design progressions for similar parts in minutes.

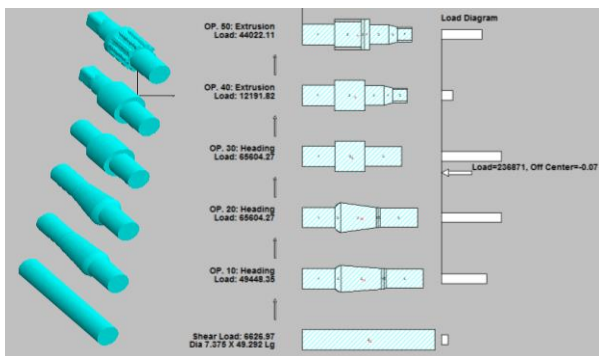


The sequence designs created in NAGFORM can be quickly validated in NAGSIM.2D / NAGSIM.3D FEA simulation programs. With NAGFORM, the user can:

- Search the database to find similar parts and the knowledge available including sequence designs, lessons learnt, tool life etc. Prevent reinventing sequence design or spending hours to design a wrong forming sequence.
- Create personalized templates of designs and then use those to 'Zip through' progression design for similar 'Family of Parts'
- Before building the tooling based on the user's design, let the program determine alternative sequence designs within minutes.

Uses

- Obtain alternative sequence designs for forming a part
- Create reusable sequence design templates of user's design.
- Save any automatic design as a template.
- Optimize and standardize designs.
- Search for knowledge on similar parts in 'Smart' database
- Select suitable machines to form a part.
- Create sequence designs for cold headers, cold formers, presses, hot formers and hot upsetters.
- Reduce number of operations required to form a part.
- Select optimal blank diameter.
- Obtain information on forming loads, pressures and deformation.
- Create analysis file for NAGSIM.2D / NAGSIM.3D for design validation
- Output sequence designs in DXF, STEP & SolidWorks.
- Teach forming design to new personnel.

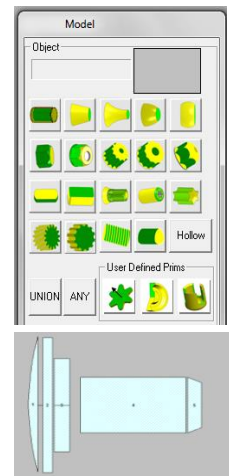


SEQUENCE DESIGN FOR COLD FORGED PARTS

Limitations - NAGFORM is not a FEA simulation program. It cannot predict metal flow defects and stresses in tools.

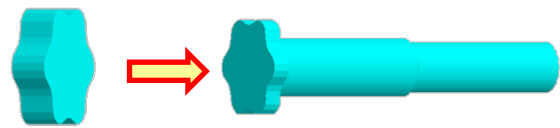
Create Part Model Using Primitives

In NAGFORM, Geometric model of a part or a preform is constructed by joining simple building blocks called primitives. All the primitives are defined by certain dimensions. The primitives are then joined together to form a union / part model. Based on the part dimensions and material, the program determines the Volume, Surface Area, and Weights. Many complex parts can be created and designed using these primitives.



User Defined Primitives

The users can create their own primitives by creating a part in .DXF or STL format and importing it into NAGFORM. The primitives once imported can be reused and scaled.



2D Face Imported from AutoCAD

Primitive Created and Modified in NAGFORM



Shape imported from 3D STL file

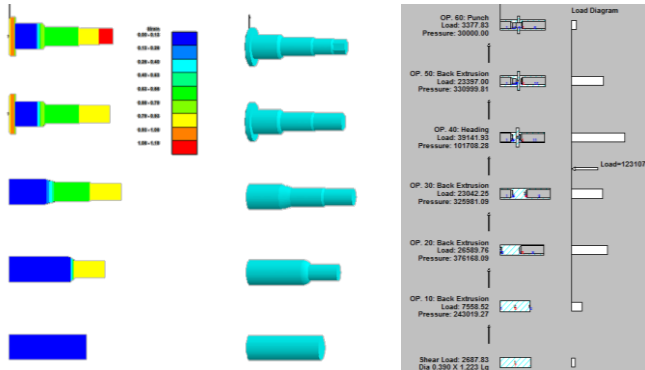
Primitive Created and Modified in NAGFORM

Automatic Designs of Forming Progressions

NAGFORM utilizes a combination of design logic, knowledge based rules and simplified analyses to determine a forming progression automatically in minutes.

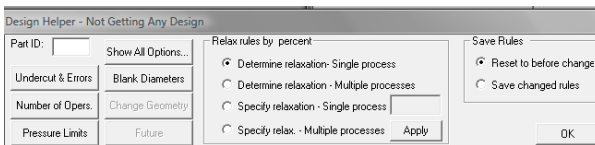
In general, there is more than one forming sequence by which a part can be formed. The number of designs depends upon the

constraints such as part geometry, material being formed, allowed number of operations and wire size. NAGFORM has its own design logic to determine various possible ways to form a part. Because the program looks for all possible designs and applies its logic without fail, NAGFORM can determine design concepts that even an experienced designer may overlook.



Design Helper

The "Design Helper" is a diagnostic tool that helps the user get a progression design when no design can be found through standard forming rules. It determines the extent to which certain rules need to be modified to get a sequence design.

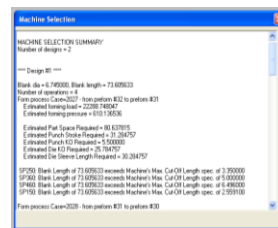


Template Designs for 'Similar' or 'Family of Parts'

- For any part that is similar to a template in the database, NAGFORM can follow the template design/session files to create forming progressions in minutes. The users have the capability to create their own reusable template designs.

Machine Selection

The automatic sequence design provides a machine selection summary showing the machines that may be used for a particular sequence design. The user can populate the machine database in NAGFORM using a simple form.



Manual Design

NAGFORM also has a separate module for creating a forming progression manually. Using computer aided techniques, the user can quickly and easily construct a forming sequence according to his/her concept. The designer can also start from a NAGFORM generated design and modify it.

Training: Regular training classes are held on NAGFORM software at the Canton MI office. In addition, web training and support is available through Web Conferencing System

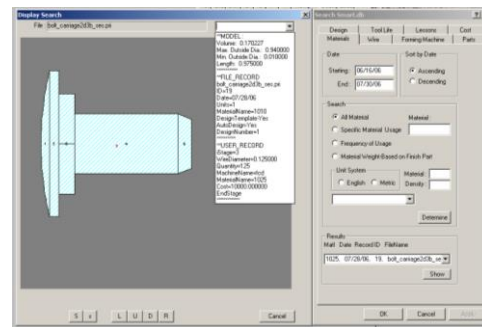
'Smart' Database

NAGFORM contains a database feature and analysis module called 'Smart' Database. The module allows the user to retain manufacturing knowledge and keep a database of parts, progressions, materials, forming machines etc. Following are some objectives of 'Smart' Database and its Analysis Module:

- Create and maintain a historic database of parts designed, quoted and manufactured
- Capture and retain the knowledge gained from experience
- Improve sequence design, quoting and manufacturing processes.
- Eliminate duplication of effort.
- Reduce print-to-part time.

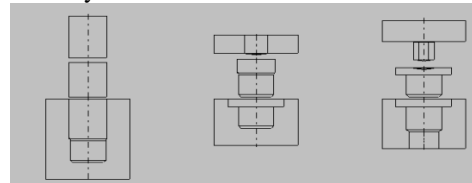
Some of the features include:

- Search for Similar Parts (Part Features, Length, Wire Size)
- Search for design - Existing auto or manual designs
- Material Usage / Wire Size Usage
- Forming Machine Usage
- Tool Life for Similar Parts
- Cost - Quoted and Manufactured
- Lesson learnt on similar parts



DXF Input and Output

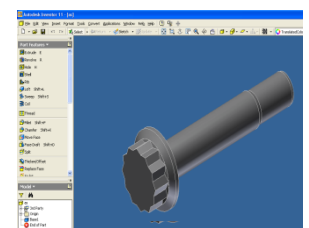
In NAGFORM, the geometry of parts can also be imported from DXF format from CAD systems such as AutoCAD, Solid Edge etc. The results of NAGFORM's sequence designs and 'Generic' tooling can be saved in DXF format for input to other CAD systems.



DXF OUTPUT OF DEFAULT TOOLING AND PROGRESSION

'STEP' File Output

The NAGFORM results including part geometry, progression designs and tooling can be exported to a STEP file. The Step files can be opened in any 3-D drawing package such as SolidWorks, Pro-E and Inventor



INVENTOR 3D CAD

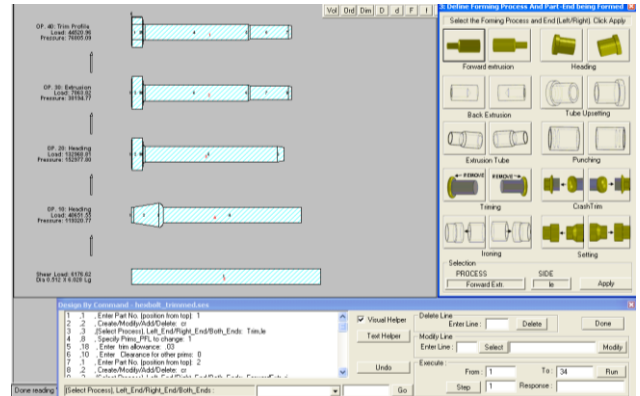
USER DEFINED PROGRESSIONS – “DESIGN BY COMMAND”

STANDARDIZE AND AUTOMATE SEQUENCE DESIGN - ‘Design by Command’ is ideal for automating and standardizing forging sequence designs of product lines such as Fasteners (Standard and Special) as well as cold formed parts such as spark plugs. The process of automating the sequence design is quite simple. The User groups the parts into ‘family of parts’ with similar shapes and forging sequence. A reusable part model and forging sequence is created in NAGFORM using ‘Design by Command’ (DCM).

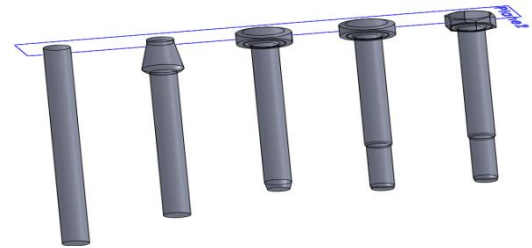
To create the sequence design for any other part of different dimensions, modify the reusable part and create the sequence using DCM.

Advantages of automating sequence design using DCM:

- Consistent Design without any human error.
- No variations in Design due to Manual Calculations.
- Reduces skill required for creating Sequence Designs.
- Design checked for obeying Forming Rules by Design Template.
- Reduces Time to Create Sequence Design from hours to minutes
- SolidWorks Models/Drawings of Part and Preforms created in couple of minutes.



Drawing generated in SolidWorks using NAGFORM



TOOLING DESIGN

The ‘Tooling Design’ section of NAGFORM helps to reduce the time required to design and draft tooling components and assemblies. This module contains two main features:

- Auto Design/Drafting of Standard Tooling Components
- Design of Tooling Assemblies

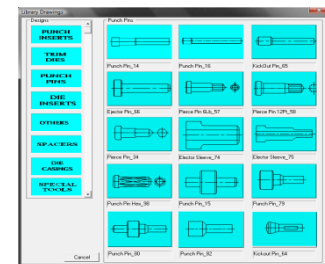
Auto Design/Drafting of Standard Tooling Components - Using NAGFORM, the User can quickly create drawings of a number of standard tooling components listed below.

- Die Inserts
- Punch Inserts, Pins
- Trim dies / punches
- Spacers – fillers
- Die/ Punch casings

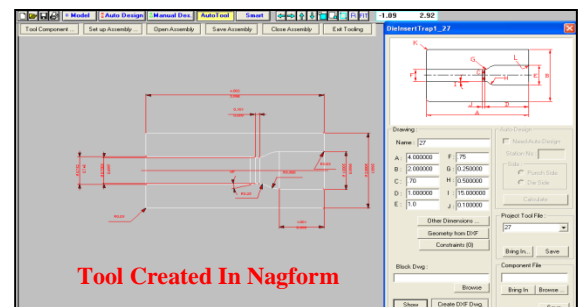
The User simply enters a few critical dimensions of the tooling component and the program instantaneously generates a fully dimensioned and scaled ‘.DXF Drawing’. The User can set constraints on the dimensions of the tool to maintain desired standards. The program also has a search feature that allows the User to search for similar tools. 3D models of the tool components can be created automatically in SolidWorks using the NAGFORM-SolidWorks Interface.

Design/Drafting of Tooling Assemblies (In Development)

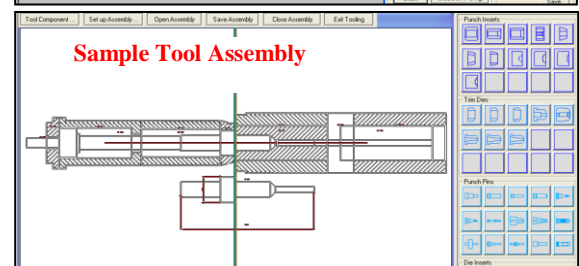
In NAGFORM, the capability to create assemblies of a multi station tooling for forming cold forged parts has been added. The procedure allows the User to create assemblies by bringing in different tool components. Once the tools are assembled and modified as needed, drawings of individual components and the assembly can be created with a few clicks of the buttons.



Standard Tool Components



Tool Created In Nagform



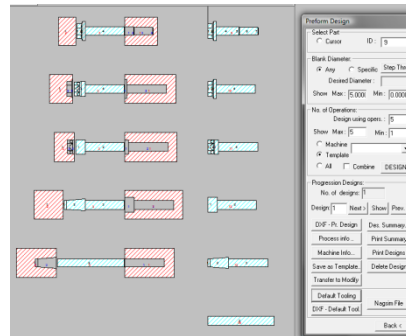
Sample Tool Assembly

INTEGRATION WITH NAGSIM.2D / 3D

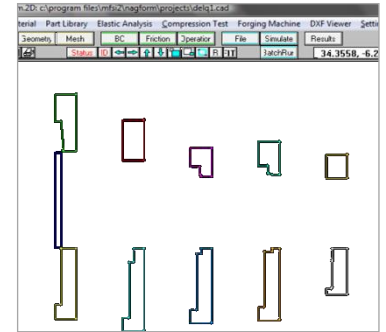
In NAGFORM, a simulation file for NAGSIM.2D/3D is automatically created for any selected part progression generated in Auto Design. For NAGSIM.2D, a single file is created for the whole progression whereas for NAGSIM.3D, one file is created for each selected station of the progression.

For NAGSIM.2D, the 'Part Progression' and the 'Default Tooling' of NAGFORM program is used to create the geometry of the part and tools in the simulation file. Thus a complete NAGSIM.2D simulation file for up to six stations progression can be created. To simulate, the User has to open this file in NAGSIM.2D, mesh the parts and begin simulating. It takes only couple of minutes to go from NAGFORM's design concept to NAGSIM.2D simulation.

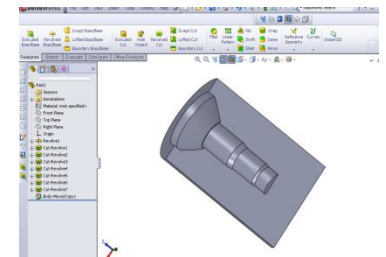
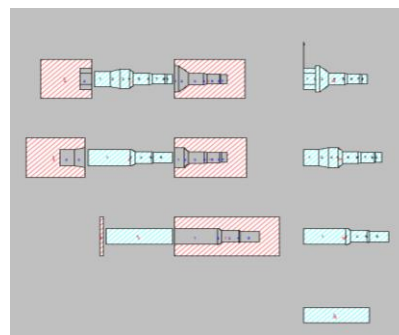
For NAGSIM.3D, NAGFORM creates the simulation file without the part and tool models. The User can either import the tool drawings from a 3D CAD models or use the NAGFORM-SolidWorks interface, to create 3D models of the default tools in SolidWorks.



DEFAULT TOOLS CREATED IN NAGFORM



AUTOMATIC CREATION OF SIMULATION FILE

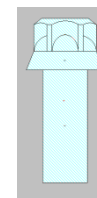
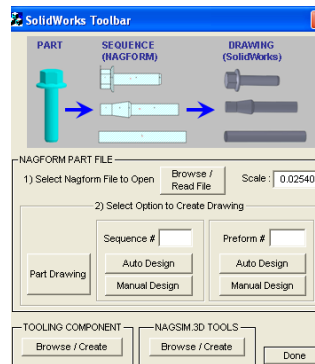


AUTOMATIC CREATION OF TOOL MODELS IN SOLIDWORKS

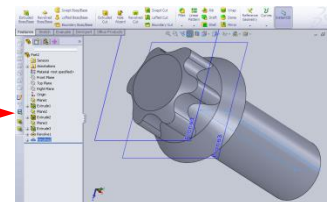
NAGFORM SOLIDWORKS INTERFACE

The new 'NAGFORM-SolidWorks Interface' toolbar allows the User to automatically generate '3D SolidWorks' drawings of NAGFORM Models and Forging Sequence Designs. Following SolidWorks part drawings can be created from an existing NAGFORM Project (.pri) file:

1. Part Model Drawing
2. Entire Forging Sequence SolidWorks Drawing from Auto Design / Manual Design
3. Specific Preform Drawing of Auto Design / Manual Design
4. Default Tool Drawings



PART MODEL IN NAGFORM



AUTOMATIC CREATION OF MODEL IN SOLIDWORKS

