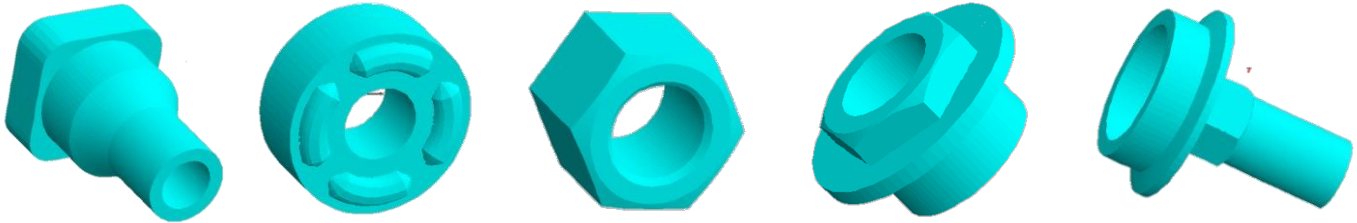


Overview

NAGFORGE is a knowledge based software program for automatic and manual design of forging sequence for hot and warm forged parts. It allows the User to capture manufacturing knowledge and use it to design progressions for similar parts. NAGFORGE utilizes a combination of design logic, knowledge-based rules and simplified analyses to determine a forging progression automatically in minutes. The sequence designs created in NAGFORGE can be validated effortlessly in 'NAGSIM_GEN.2D' FEA simulation programs. NAGFORGE also has a 'Smart' database to store 'knowledge' and use it to improve the design and manufacturing processes.



Uses

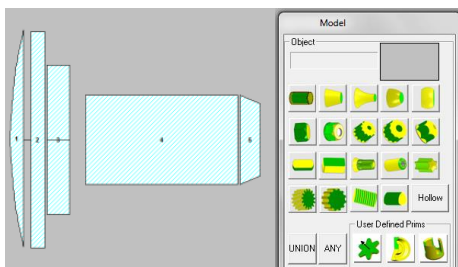
- Obtain alternative sequence designs for forging a part in minutes.
- Create reusable sequence design templates
- Search its 'Smart' database to find similar parts and their history.
- Create hot forging part profile from machined part profile.
- Calculate die angle for Chevron free extrusion.
- Calculate flash dimensions for closed die forgings.
- Optimize and standardize forging sequences.
- Reduce number of forming operations required to form a part.
- Select optimal rod diameter.
- Obtain forming loads, pressures etc.
- Prevent design that disobey the forming rules or overloads the tools.
- Teach forming design to new personnel.

Limitations

- NAGFORGE is not a FEA simulation program. It cannot predict metal flow defects and stress distribution in tools.
- NAGFORGE can be used only for the parts with some symmetry such as parts made on upsetters, closed die forgings with or without flash and open die forging of symmetrical and long parts.

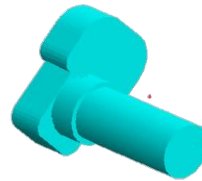
Create Part Model Using Primitives

In NAGFORGE, 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 Weight. Many complex parts can be created and designed using these primitives.

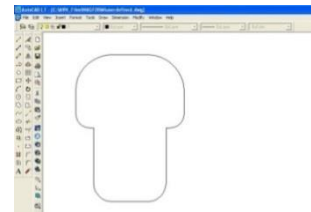


User Defined Primitives

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



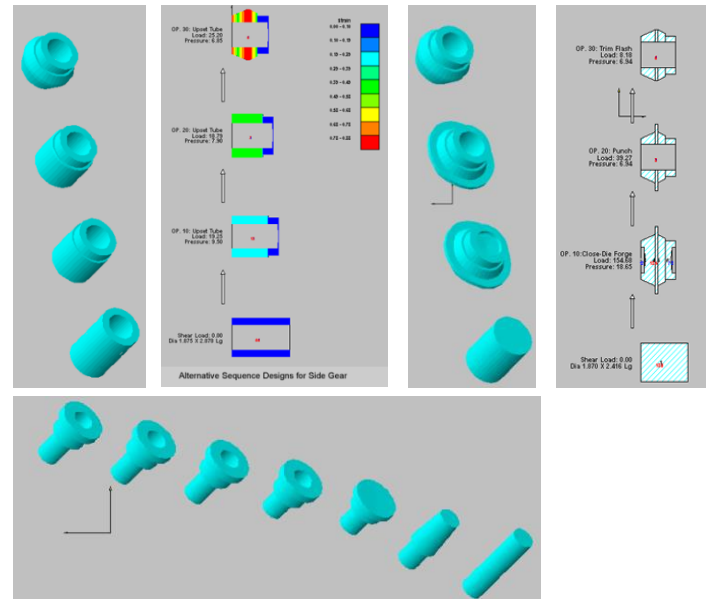
PART CREATED WITH USER DEFINED PRIMITIVE



USER DEFINED PRIMITIVE IMPORTED FROM AUTOCAD

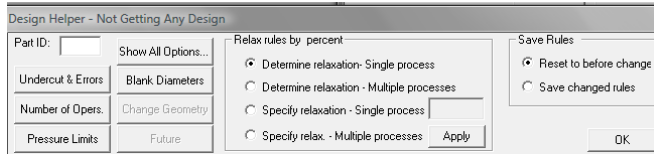
Alternative Forging Progression in Minutes

In general, there is more than one forging 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, wire/rod size etc. NAGFORGE has its own design logic to determine various possible ways a part can be formed.



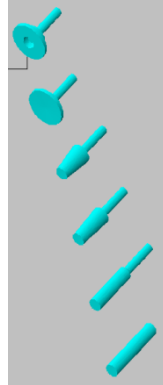
Design Helper

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.



Design by Command

‘Design by command’ feature allows the user to create his/her own design interactively in few minutes. The interactive session, consisting of questions by the program to determine the design intent and the responses of the user, is saved in a session file. This session file can be used as a template to create progression design for similar ‘Family of Parts’ in minutes.



Objectives of NAGFORGE Smart Database

- 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.

Search and Analysis Capabilities of ‘Smart’ Database

- Part Search for similar parts, parts with certain features such as hex, lobe etc. parts within specified length, diameter and volume.
- Design: Existing auto or manual designs for current or similar parts.
- Material - usage
- Rod size – usage
- Forming Machine – usage
- Tool life – for similar parts
- Cost – quoted and manufacturing.
- Lessons learnt on similar parts.

Template Design for “Similar Parts” or ‘Family of Parts’

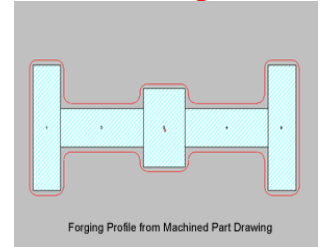
For any part that is similar to a template in the database, NAGFORGE can follow the template design/session file to create forging progression in minutes.

Manual Design

In addition to Automatic design, NAGFORGE has a separate module for creating a forging progression manually. Using computer aided techniques, the users can quickly and easily construct a forming sequence according to their own concept. The designer can also start from a computer-generated design and modify it.

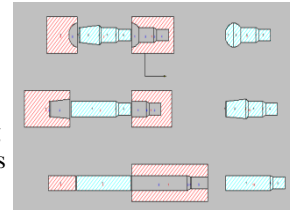
Forging Profile from Machined Part Drawing

‘NAGFORGE has a separate module for creating Forging Profile from machined part drawing. User can specify machining allowance on outside profile as well as bore. Fillet and corner radii as well as forging draft angles can be specified.



Generic Tooling for FEA Simulation

For the sequence designs obtained through NAGFORGE’s logic, ‘Generic’ tooling can be created automatically. This generic tooling can be used to simulate the forming operation in a FEA program such as NAGSIM_GEN.2D.



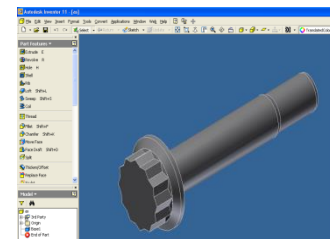
Automatic creation of NAGSIM_Gen.2D Analysis File

For some of the sequence designs, NAGFORGE can create the analysis file for simulation of the sequence design in NAGSIM_GEN.2D. For new parts, for which tooling designs are not available, this saves considerable effort required to create process drawings for FEA simulation.

DXF Input and Output - In NAGFORGE, the geometry of round parts can also be imported in DXF format from CAD systems such as AutoCad, SolidEdge etc. The NAGFORGE output including sequence designs can be saved in DXF format for input to other CAD systems.

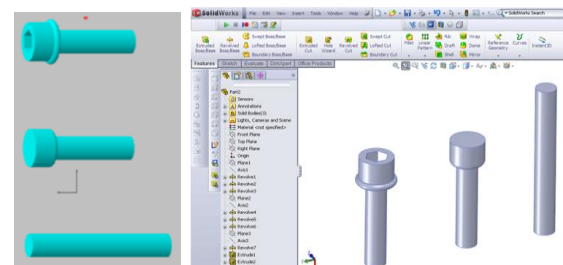
‘STEP’ File Output

The NAGFORGE 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

NAGFORGE SolidWorks Interface - The ‘NAGFORGE-SolidWorks Interface’ toolbar allows the user to automatically generate ‘3D SolidWorks’ drawings of NAGFORGE results (Part, Progressions and Default Tool Drawings)



AUTOMATIC CREATION OF MODEL, PROGRESSIONS AND GENERIC TOOLS IN SOLIDWORKS