

**SHORT COURSE  
ON  
SHEET METAL FORMING  
FUNDAMENTALS AND APPLICATIONS**

The attendees will receive 1) a Workshop booklet that contains all the slides used in the class, and 2) a CD that contains figures, text (in PDF format) and some of the animations that will be used in the class.

**COURSE CONTENT**

**1. Sheet Metal Forming Processes - Introduction**

- Outline of the Course
- Introduction to Various Processes
- Applications

**2. Sheet Metal Forming as a System**

- Sheet Forming as a System
  - Process Variables
  - Mechanics of Materials
  - Material Properties
  - Tensile Test
  - Flow Stress Curves
  - Anisotropy and its Effects
  - Sheet Formability
  - Hydraulic Bulge Test
  - Friction and Lubrication
  - Presses and Equipment
  - Product Quality
- Appendices:**
- Appendix A – Tensile Test
  - Appendix B – Viscous Pressure Bulge Test

**3. Friction and Lubrication in Sheet Metal Forming**

- Parameters that influence Friction
  - Surface Finish
  - Lubrication in Sheet Metal Forming
  - Evaluation of Lubricants in Sheet Metal Forming
- Appendices:**
- Appendix A – LDH Test

#### 4. Presses for Sheet Metal Forming

- Introduction
- Classification of the Presses
- Mechanical Presses and their Construction
- Hydraulic Press and their Construction
- Comparison of Mechanical and Hydraulic Press
- Force, Torque and Energy Requirement of Press
- Universal Press
- Transfer Press

#### 5. Blanking

- Deformation in Blanking
- Forces and Stress Conditions in Blanking
- Formation of the Part Edge
- Types of Blanking Dies
- FEM applied on the Blanking Process

#### 6. Bending, Flanging and Hemming

- Bending Processes
- Elementary Bending Theory
- Bendability of Materials
- Springback and Residual Stresses
- Straight, Shrink and Stretch Flanging
- Hemming Technology, Analysis and Design

##### Appendices:

- Appendix A – Bending
- Appendix B – Flanging
- Appendix C – Hemming

#### 7. Deep Drawing of Round Cups

- Process Overview
- Applications
- Tooling for Round Cup
- Process Parameters
- Prediction of Loads and Geometry
- Round Cup Tooling Investigation, Experiments and Simulation

##### Appendices:

- Appendix A – Effect of Blank Diameters
- Appendix B – Effect of n Value
- Appendix C – Effect of Different Friction Coefficients
- Appendix D – Effect of Blankholder Force

#### 8. Deep Drawing and Stamping of Irregular Shapes

- Introduction to Deep Drawing
- Empirical Methods
- Effect of Process Parameters
- Simulation Methodology
- Dies and Tooling

##### Appendices:

- Appendix A – Simulation of the Fender Outer

**9. Defects and Product Quality**

- Defects and Failure Modes
- Fracturing
- Buckling and Wrinkling
- Shape Distortion
- Stretcher Strain Markings
- Springback

**10. Process Modeling**

- Roof Panel – Oil Canning
- Cabin Inner – Optimal Process
- Fastform3D - Validation
- Instrument Cover – Blank Shape

**11. Discussion**

*Scroll Down for Course Fees and a List of Past Events organized by ERC/NSM*

### **COURSE FEES**

**A. When the course is given at a hotel or university, or in cooperation with a conference:**

Per person: \$495.00 – includes a booklet that contains black & white copies of the slides used.

**B. When the course is given at a company location:** Per person: \$450.00 – includes a booklet that contains black & white copies of the slides used and one copy of a CD (that contains the power point slides, animations and other stamping modules). Minimum of 8 people (or \$3600) plus travel expenses for the instructor.

**C. The course is provided on a CD only:** It is possible to purchase this course, together with appropriate modules, on CD (that contains the power point slides, animations and other stamping modules). The cost will be \$450 per CD + \$15 shipping and handling.

For further information, please contact ERC/NSM Office:

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### **PAST EVENTS**

**Course in Advance Sheet Metal and Tubular Forming**, March 24-28, 2003, Olofstrom, Sweden

**The 5th International Conference, Workshop and Exhibits on Advances in Sheet Metal Forming Technology, Sponsored by: SME and ERC/NSM**, April 12-13, 2000, Romulus (Detroit), Michigan

**The 3rd International Conference on Sheet Metal Forming Technology, Sponsored by: FMA and ERC/NSM**, October 5-7, 1998, Columbus, Ohio

**The 2nd International Conference on Sheet Metal Forming Technology, Sponsored by: ERC/NSM**, October 9-11, 1996, Columbus, Ohio

**The 1st International Conference on Sheet Metal Forming Technology, Sponsored by: ERC/NSM**, October 3-5, 1994, Columbus, Ohio