# International Seminar on Advanced Material Processing and Material Modeling for Steel Sheets

【開催日】 2018年2月9日（金）14:00～17:00

【開催場所】東京農工大学 小金井キャンパス 6号館3階0631教室（電話（042）388-7083）
http://www.tuat.ac.jp/outline/overview/access/koganei/campus_map/

【共催】 日本鉄鋼協会 創形創質工学部会，東京農工大学 グローバルイノベーション研究機構（GIR）
日本塑性加工学会 板材成形分科会，プロセッシング計算力学分科会

【趣旨】板材成形および材料モデルの研究に携わる海外の著名な研究者を日本に招聘し，鉄鋼材料の変形特性や材料モデルに関する最新の研究成果を紹介する国際セミナーを開催します．高次異方性降伏関数で世界的に有名なBarlat教授からは，バウシンガ効果を考慮した高張力鋼板の2工程U曲げスプリングバック解析について，新進気鋭のCoppieters博士からは，画像相関法を用いた厚鋼板の局部くびれ後の加工硬化特性の測定手法について御講演頂きます．最後に，多軸応力試験や応力反転試験に基づく鋼板の塑性変形特性および成形シミュレーションの例をご紹介します．セミナー終了後には講師の先生方との交流・議論の場を設けます．

【参加費】 講演会：無料，技術懇談会：実費（3,000円程度）

【プログラム】

**14:00-14:10 Opening greetings** **Toshihiko Kuwabara, Tokyo Univ. Agriculture & Technology**

**14:10-15:00 Constitutive modeling of advanced high strength steel sheets for springback prediction after double stage U-draw bending**

**Frederic Barlat, POSTEC**

**Abstract:** A U-shaped channel formed using a double drawing process (double stage U-draw bending) was proposed to reduce the amount of springback in the AHSS sheets. The performance of the double stage U-draw bending process in reducing the amount of springback was compared with that of the conventional U-draw bending process. The process was simulated using a finite element (FE) analysis with two different types of anisotropic hardening models, namely, isotropic-kinematic and distortional models, to describe the Bauschinger effect and associated anisotropic hardening transients during the strain-path changes. Moreover, plastic anisotropy, captured by different yield functions, and the degradation of the elastic modulus were taken into account. In addition to the basic mechanical characterization tests conducted to identify the material coefficients, in-plane compression–tension experiments were conducted. The experimental and FE simulated results of the double stage U-draw bending process were compared and analyzed to understand the effect of anisotropic hardening on the springback under non-proportional loading.

**15:00-15:50 Investigation into the plastic material behavior up to fracture of thick S690QL high strength steel using FEMU and multi-DIC**

**Sam Coppieters, KU Leuven**

**Abstract:** Steel is one of the most important materials employed in heavy duty machinery and heavy goods vehicles. Evidently, the improvement of steel properties is key to enhance the mechanical performance of those structures. The development of advanced high strength steel grades enabled to reduce the weight of steel structures whilst maintaining or even improving the strength. For S690QL, however, the increase in strength does not correspond with an increase in ductility. As such, in-use brittle fracture might be a safety risk and the application of this grade requires a profound understanding of plastic material behavior up to fracture. In this presentation, finite element model updating (FEMU) along with multi-DIC is used to identify post-necking strain hardening, inhomogeneous through-thickness yielding and plastic anisotropy of thick S690QL high strength steel.

**15:50-16:10 Coffee Break**

**16:10-17:00 Measurement and analysis of the mechanical behavior of steel sheets using multiaxial stress tests and stress reversal tests**

**Toshihiko Kuwabara, Tokyo Univ. Agriculture & Technology**

**Abstract:** Mechanical behavior and material models of steel sheets are investigated using multiaxial stress tests and stress reversal tests. In part I, an accurate material model of an ultralow carbon steel sheet is determined using multiaxial stress tests. It is observed that the accuracy of hole expansion forming simulation is improved when a proper material model is used in the analysis. In part II, simple shear tests of an ultralow carbon steel sheet are performed by applying torque to cylindrical specimens made of a flat sheet sample. The shear stress directions are changed so that the direction of the maximum principal stress becomes parallel to the rolling, 45-degree and transvers directions. It is observed that the shear stress vs. shear strain curves slightly deviate each other with the change in the shear stress direction. In part III, in-plane tension-compression stress reversal tests and pure bending tests of a DP980 steel sheet are performed. It is observed that the strength differential effect, the difference in flow stresses between tension and compression, clearly affects the bending moment vs. curvature diagrams.

**17:00-18:30 技術懇談会**（場所は追って御連絡します）