<div align="center">学位論文概要</div>

題　目　Elimination of Springback of High Strength Steel Sheets Using Additional Bending with
　　　　Counter Punch

<div align="center">（カウンターパンチによる付加的曲げを利用した高張力鋼板のスプリングバックの解消）</div>

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Elimination of springback is a key issue in press forming of HSS sheets. Although much effort has been made for controlling and compensating springback by proposing several stamping technologies, it is still not so easy to obtain accurate shapes of sheet products. In this thesis, a novel technology to eliminate springback of high strength steels in U-bending process is proposed. In this technology, bending moment, which is a driving force of springback, is reduced by additional bending with the counter punch ('pushing-up') and bottoming at bent corners ('corner bottoming').

In Chapter 1, the background and inspiration of the research were presented by giving an overview of previous works on technologies of springback control and compensation. The objective and contents of the thesis were described.

In Chapter 2, outlines of two types of U-bending technologies: (1) bottom pushing-up technology; and (2) combined corner bottoming and bottom pushing-up technology, and the details of experimental set up process parameters were presented.

In Chapter 3, for prediction springback behavior an accurate FE simulation the Yoshida-Uemori kinematic was described.

In Chapter 4, a new technology of bottom pushing-up with a counter punch to eliminate U-bending springback was proposed. The reduction of springback in this process is attributed to the negative bending moment generated at the bent-corner part of the sheet, which is   the driving force of 'spring-go'. It was verified from experiments on 980Y HSS sheet and the corresponding numerical simulations.

In Chapter 5, specifically for a U-shaped product with a small bottom plate, a new technology of combined corner bottoming and bottom pushing-up was proposed to eliminate springback. The mechanism of reduction of springback in this process was discussed based on the FE simulation.

In chapter 6, conclusions of the present work are summarized with some remarks. The new technologies proposed for elimination of U-bending springback of HSS sheets will be directly applied to real stamping operation in industry. One of the great advantages of the technologies is that it is applicable for any types of HSS sheets (in terms of strength level and sheet thickness) and any shapes (e.g., corner radius, length of bottom plate, etc.) of U-bent products by determining optimum process parameters of corner bottoming and bottom pushing-up forces.