出國報告（出國類別：參與研討會）

參加 **2017 GCEAS** 國際學術研討會報告

服務機關：國立虎尾科技大學

姓名職稱：陳立緯 助理教授

派赴國家：日本沖繩

出國期間：106 年7 月24 日至 7 月27 日

報告期間：106 年 8 月 7 日

摘要

本次於 7 月 25 日至 7 月 27 日參加於日本沖繩舉行之工程及應用科學國際研討會(Global Conference on Engineering and Applied Science , 2017 GCEAS)，並發表 Analysis of the cooling system for hot stamping die using CFD software 論文，本次研討會共有來自數十個國家及地區之多位學者專家及研究人員參與，3 天的交流活動不論是會議期間的演講，口頭、海報發表均獲益良多，該研討會的形式與個人之前均選擇參與主題較為侷限的研討會有很大的差異，但也因此有機會與許多其他工程相關領域的學者進行討論，雖與個人發表之主題與研究領域有較大的不一樣，無法提供學術上的專業意見，但也因為如此，可以了解到各工程領域相關的研究，且在問題討論與交流的過程中也發現，各領域學者對於研究的思維不盡相同，這樣的交流方式，讓個人瞭解目前不同學科發展的趨勢，提供不同的研究視野，吸收不同的專業知識，有助於報告人未來研究之進行與精進。

目次

一、 目的

參加工程及應用科學國際研討會(Global Conference on Engineering and Applied Science , 2017 GCEAS) ，發表 Analysis of the cooling system for hot stamping die using CFD software 論文，並藉此了解工程分析技術之發展方向，以做為未來研究計畫之參考。

2017 GCEAS 是一個著重於工程但主題廣泛多元的國際會議論壇，涵蓋主題包含生物醫學工程，化學工程，土木工程，計算機與信息科學，電機與電子工程，環境科學，基礎科學和應用科學，地球科學和石油工程，材料科學與工程，機械工程，系統及船舶機電工程學。2017 年 7/25-7/27 於日本沖繩舉行，本次研討會共有來自數十個國家及地區之多位學者專家及研究人員參與，以口頭報告或是海報張貼的方式發表其在專業領域的最新成果。參與此國際會議主要為增進個人在於研究開發之精進，並藉此交流瞭解世界各地與工程領域研發與應用之狀況，是研發人員吸取新知最有效率的方式，且國際研討會參與人員遍及世界各國，可更有效率的開拓視野與增廣見聞，了解他國家的最新發展方向，並以此作為自身未來研究發明的參考。

二、 過程

本次工程及應用科學國際研討會(Global Conference on Engineering and Applied Science , 2017 GCEAS) 7/25-7/27 於日本沖繩舉辦，會議進行時間為 3 天，個人於 7/24 晚間由台灣出發，當晚於那霸旅館過夜，並於 7/25 抵達研討會會場沖繩宜野灣會議中心。研討會於 7/26 正式展開，一開始知主題演講分為社會科學與自然科學兩類，我則選擇自然科學類的主題，由加拿大 Simon Fraser University 的 Dr. Paul Li 擔任演講人，主題為: Microfluidic nanotechnology: what does it do for you? 此主題雖於個人所學同領域，但因特別應用於電子零件微流道設計，令我印象深刻。

此次會議個人發表論文安排於 7/26 上午，此次研討會主題眾多，個人之發表被安排於 Sessions (1)，Electrical and Electronic Engineering / Mechanical Engineering，於了解同場次其他主題時發現發表議題不局限於機械製造領域，包含自動化焊接、光纖、雷射量測等各工程相關領域均有，從中令我思考跨領域研究的可行性，另外，此研討會台灣學者多人參加，會中除遇到本校光電系鄭旭志主任外，亦遇到台科大、聯合大學、東海大學等多所學校教授，另外亦於日本及韓國等地學者有短暫的接觸與交流，會議期間與各學者之間的研究討論及國際學者的互動中，受益良多，研討會於 7/27 結束，個人隨即於 7/27 晚間搭機返台。此次研討會會場相關場景與個人參與會議狀況之照片如圖 1-4 所示。

圖 1 研討會會場場景

圖 2 與其他與會者合影

圖 3 研討會表演節目

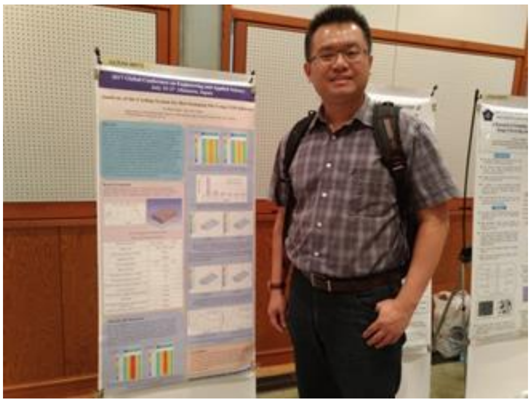


圖 4 報告人與海報合影

此次個人以流體力學專用軟體應用於熱沖壓模冷卻水到分析為主題發表，熱沖壓(Hot stamping)成形技術是將板料成形和冷卻淬火相結合的複雜成形技術，以同厚度的金屬板金相比，此法成形之板金零件強度比傳統成形法之零件提升 2 至 3 倍，熱沖壓成形零件的材料組織及機械性質主要取決於成形過程中，沃斯田鐵轉化為麻田散鐵的程度，而麻田散鐵轉化程度依賴於成形件的冷卻速度及冷卻均勻性，因此，熱沖壓成形模冷卻水道設計及其參數之優劣，對於熱沖壓成形零件之品質有直接的影響，本研究利用流體力學分析軟體 Fluent 進行熱沖壓模之冷卻水道分析，模具熱傳分析之參數，包含分析水道與模面及與水道間的距離、水道之幾何形狀及冷卻水道水流之進口溫度、流速、壓力及長度等，找出最佳化水道型態設計後，進行冷卻水道熱傳分析及溫度分佈量測等實驗，希望藉由此方式了解複雜造型零件在進行熱沖壓成形時，其模具表面之實際溫度分佈其冷卻情形，試圖與金屬相變溫度做比較，設計出最佳化熱沖壓模具冷卻水道參數。本次研討會個人發表之論文摘要、發表海報及邀請函及如下:

Analysis of the cooling system for hot stamping die using CFD software

Hot stamping is a technique to combine the metal sheet forming process with quenching process. The strength of panel part can be increased by 2-3 times after hot stamping process. The quality of hot stamped panel depends on the distribution of martensitic microstructure. To form the high quality of martensitic structure steel, the uniform cooling rate on the die face is needed. In order to know the cooling system effect on hot stamped panel, CFD software was used to analyse the cooling system of hot stamping die. The cooling system was firstly employed in a flat-shaped tooling. The simulation model including hot stamping die, workpiece and cooling channel was built. The effect of the heat transfer on the quenching process was also considered. Parameters of distance between cooling channels, the distance between cooling channels and die face, the temperature and the velocity of cooling water and the length of cooling channels will be discussed. Results indicate that the CFD software can be used to predicate the temperature distribution of die face during the quenching process. The die face temperature will then be used to analyse the phase transition temperature of steels. It is hoped that the results obtained in this paper could provide as a reference for the cooling system design of hot stamping die.

***Keywords**:* Hot stamping, Cooling channel, Heat transfer, Finite element analysis

2017 Global Conference on Engineering and Applied Science
July 25-27 Okinawa, Japan

Analysis of the Cooling System for Hot Stamping Die Using CFD Software

Li-Wei Chen*, Yu-Chi Chou

Department of Mechanical and Computer-Aided Engineering, National Formosa University, Taiwan
*E-mail address: liwei@nfu.edu.tw

Abstract

Hot stamping is a technique to combine the sheet forming process with quenching process. The strength of panel part can be increased by 2-3 times after hot stamping process. The quality of hot stamped panel depends on the distribution of martensitic microstructure. To form the high quality of martensitic structure steel, the uniform cooling rate on the die face is needed. In this study, a CFD software was used to analyze the cooling system of hot stamping die. The simulation model including hot stamping die, workpiece and cooling channel was built. Parameters of distance between cooling channels, the distance between cooling channels and die face, the temperature and the velocity of cooling water and the length of cooling channels will be discussed. Results indicate that the CFD software can be used to predicate the temperature distribution of die face during the quenching process. It is hoped that results obtained in this research could provide as a reference for the cooling system design of hot stamping die.

Research method

A flat-shaped tooling with four cooling channel was designed to analyze heat transfer of die face. Detailed configuration of tooling is shown in Fig.1. The simulation parameters is shown in Table 1.

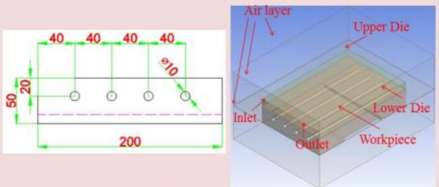


Fig.1 The setting of hot stamping tooling

Table 1. The Simulation Parameters

Material of sheet	CSC-15B22	S45C
Sheet size	300 x140x 2 (mm)	
Initial temperature of sheet	900℃	
Material of Die	SKD61	
Inlet Temperature	15℃	25℃
Water velocity	8 m/s	
Turbulence intensity of water	7.03%	
Turbulence intensity of air	5%	
Heat Transfer Coefficient (W/m² • K)	8	
Air cooling time	10 sec	
Contact time of upper and lower die	50 sec	
Elements	730000	
The distance between cooling channel and die face	20mm	
Distance between cooling channels	40mm	

Results and discussion

The inlet temperature of cooling water and the material of sheet panel were firstly set as the main parameters in this simulation study. The velocity of cooling water was set at 8m/s in all case. CSC-15B22 and S45C were the test materials. The temperature destruction of die face and cooling channel, and the temperature variation within the time in the case of inlet temperature of 15℃ were shown in fig. 2 to fig. 5.

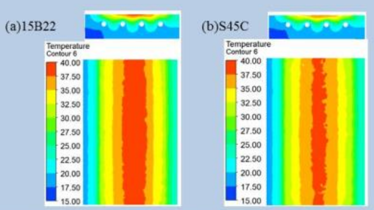


Fig.2 Temperature distribution of die face in the case of inlet temperature of 15℃. 60s after heated sheet put on the die face under the conditional of cooling water velocity of 8 m/s. (a) 15B22 (b) S45C

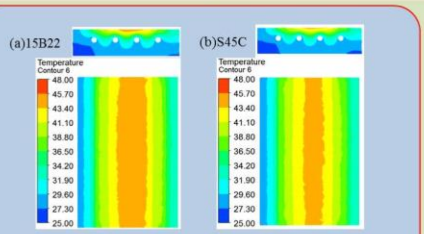


Fig.3 Temperature distribution of test sheet, 60s after heated sheet put on the die face under the conditional of cooling water velocity of 8 m/s. (a) 15B22 (b) S45C

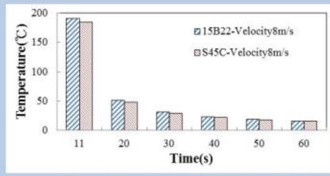
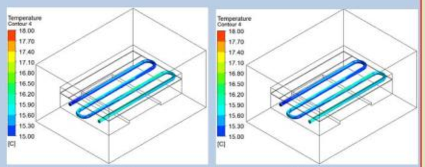


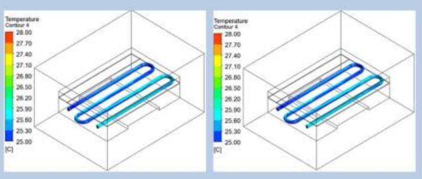
Fig.4 Temperature variation of test sheet during hot stamping process under the conditional of cooling water at 25℃ and the velocity was 8m/s.



(a)15B22 (b)S45C

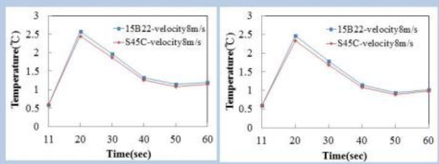
Fig. 5 Temperature distribution of cooling channel in the case of inlet temperature of 15℃, 60s after heated sheet put on the die face under the conditional of water velocity of 8 m/s. (a) 15B22 (b) S45C

The temperature destruction of cooling channel, and the temperature variation within the time in the case of inlet temperature of 25℃ were shown in fig. 6 and fig. 7.



(a)15B22 (b)S45C

Fig.6 Temperature distribution of cooling channel in the case of inlet temperature of 25℃, 60s after heated sheet put on the die face under the conditional of water velocity of 8 m/s. (a) 15B22 (b) S45C



(a) Inlet temp. was 15℃ (b) Inlet temp. was 25℃

Fig.7 Temperature difference between inlet and outlet (a) inlet temp. was 15℃, (b) inlet temp. was 25℃

Conclusions

Finite element software Fluent was used to analyze the cooling system of the hot stamping die in the present study. Temperature distribution of die face, test sheet and cooling channel was clear shown. Results indicate that the CFD software could be used to predicate the temperature distribution of die face during the quenching process.

Advanced Forging-Stamping and Engineering Lab.

Acceptance Letter

2017 Global Conference on Engineering and Applied Science (GCEAS)
July 25-27, 2017 at Okinawa, Japan

Paper ID: GCEAS-0075
Title: Analysis of the cooling system for hot stamping die using CFD software

Dear Li-Wei Chen, Yu-Chi Chou,

We sincerely appreciate your paper submission. On conclusion of the peer-reviewed process, we are pleased to inform you that your paper is accepted for Poster presentation at Global Conference on Engineering and Applied Science (GCEAS 2017) in Okinawa, Japan. Decisions were made based on a double-blind review process. The exact time and room of your presentation session will be specified in the GCEAS Conference Program online at http://www.gceas-conf.org/ generally a month ahead the conference date.

Please make sure your manuscripts conform to the writing format which is available on the conference website. Furthermore, GCEAS 2017 policy requires at least one author to register for and attend the meeting to present the paper. Papers with unfinished payment by the deadline will be withdrawn from the conference program and proceedings. We highly appreciate your cooperation.

If you have any further questions, please do not hesitate to contact the secretariat of GCEAS 2017 by sending your email gceas@gceas-conf.org with your manuscript ID number listed above on all communications. Again, congratulations on the acceptance of your paper. On behalf of the Program Committee, we look forward to your full participation in the GCEAS 2017 Conference.

With best wishes and greetings to you,
The Program Committee of GCEAS 2017

For and on behalf of
HIGHER EDUCATION FORUM

Conference Venue : Okinawa Convention Center
4-3-1 Mashiki, Ginowan City Okinawa 901-2224, Japan
Tel: +81(0)98-898-3000

三、 心得與建議

此次非常感謝有機會能夠參加國際研討會，個人第一次參加 2017 GCEAS 研討會，該研討會的形式與個人之前均選擇參與主題較為侷限的研討會有很大的差異，但也因此有機會與許多其他工程相關領域的學者進行討論，雖與個人發表之主題與研究領域有較大的不一樣，無法提供學術上的專業意見，但也因為如此，可以了解到各工程領域相關的研究，且在問題討論與交流的過程中也發現，各領域學者對於研究的思維不盡相同，這樣的交流方式，提供個人未來研究更開闊的視野，避免將研究侷限於自己所瞭解的領域，而忽略較為廣泛性的思考，本次參與此研討會的經驗，也讓我認真思考結合跨領域研究的可行性，避免一昧的專研於同一侷限的主題，而限制自己的專業性，當然，在參與此國際會議聽取演講、口頭發表及觀看海報後，更瞭解未來發展與應用趨勢，為後續研究充實學理以及產業發展之知識。未來建議相關研究人員，不一定總是參與非常專業性的研討會，有機會可參與這種領域較廣泛的研討會，除開拓本身的研究視野外並且擴展國家能見度。