



## ICPMMT 2022 Keynote Speech

### Recent Developments and Applications of Tube Hydroforming Technology

#### Professor Yeong-Maw Hwang

##### BACKGROUND



Yeong-Maw Hwang is currently a distinguished professor in National Sun Yat-sen University. He earned his Doctor's degree (1990) in industrial mechanical engineering from Tokyo University in Japan. He had been a visiting professor in the Ohio State University (1999-2000 and 2005-2006). He has been a professor, Department of Mechanical and Electro-Mechanical Engineering (MEME), National Sun Yat-Sen University (NSYSU), Kaohsiung, Taiwan, since 1996. He has ever served as the department chair (2002-2005 and 2017-2020) of MEME. His research interests have been in the areas of metal forming, design and analysis of micro-generators, machine design and mechanics analysis. He won the Best Paper Award (1992) and Outstanding Engineering Professor Award (2007) from Chinese Society of Mechanical Engineers in Taiwan.

He earned the Fellow title from Japan Society for Technology of Plasticity (JSTP), Japan (2012) and Distinguished Professor of NSYSU (2012). He was elected as the president of Taiwan Society for Technology of Plasticity (TSTP) for two terms equating to four years 2017-2020.

##### EDUCATIONS

1. Ph.D. Tokyo University, Japan. (1990)
2. M.S. National Tsing Hua University, Taiwan (1983)
3. B.S. National Tsing Hua University, Taiwan (1981)

##### RELEVANT WORK EXPERIENCES

2012- present	Distinguished Professor, National Sun Yat-sen University, Kaohsiung, Taiwan
2017- 2020	Department Chair, National Sun Yat-sen University, Kaohsiung, Taiwan
2014- 2017	Vice Dean of Engineering College, National Sun Yat-sen University, Kaohsiung, Taiwan
2005- 2006	Visiting Professor, Ohio State University/ME, USA
2002- 2005	Department Chair, National Sun Yat-sen University, Kaohsiung, Taiwan
1999- 2000	Visiting Professor, Ohio State University/ERC, USA
1996- 2012	Professor, National Sun Yat-sen University, Kaohsiung, Taiwan
1990- 1996	Associate Professor, National Sun Yat-sen University, Kaohsiung, Taiwan

##### RESEARCH AREAS

1. Plasticity
2. Metal forming
3. Machine design



4. Control theory
5. Micro-Electro-Mechanical System (MEMS)

## ACADEMIC AWARDS

1. Best Paper Award from Chinese Society of Mechanical Engineers (CSME), 1992 ◦
2. Distinguished Award from National Science Council (NSC) of Taiwan, 1992-2000 ◦
3. Excellent Research Award from National Sun Yat-sen University (NSYSU), 2004
4. Outstanding Mechanical Engineer Award from Chinese Society of Mechanical Engineers, Kaohsiung Chapter (CSME), 2006.
5. Outstanding Engineering Professor Award from Chinese Society of Mechanical Engineers (CSME), 2007.
6. **Fellow** of Japan Society for Technology of Plasticity (JSTP), Japan. 2012.
7. **Distinguished Professor** of National Sun Yat-sen University (NSYSU), 2012-2015
8. **Excellent Paper Award** from Taiwan Forging Association (TFA), 2013, 2017
9. **Distinguished teacher Awards** in academic research and industrial collaboration research from National Sun Yat-sen University (NSYSU), 2015-2021

## SELECTED JOURNAL PAPERS (2016-2021)

1. **Y.M. Hwang**, Y. Chen and S. Alexandrov, 2016 “Manufacture of Magnesium Tubes with Gradient Hardness Distribution using a Two-stage Porthole Extrusion Die,” Key Engineering Materials, Vol. 716, 49-54. (EI)
2. G.Y. Tzou, **Y.M. Hwang**, H.Y. Teng, 2016, "Analysis of Rotating Piercing Process with Constant Shear Friction," Journal of the Chinese Society of Mechanical Engineers, Vol.37, No.3, 259~267. (SCI)
3. **Y.M. Hwang**, S.Y. Hsieh and N.J. Kuo, 2016 “Study of Large-Expansion-Ratio Tube Hydroforming with Movable Dies,” Key Engineering Materials, Vol. 725, 616-622. (EI)
4. **Y.M. Hwang**, C.C. Kan, 2017, “Roll shape design for foil rolling of a four-high mill,” International Journal of Advanced Manufacturing Technology, Vol. 91, 1587–1597 (SCI, EI)
5. **Y.M. Hwang**, R.K. Wu, 2017, “Process and loading path design for hydraulic compound forming of rectangular tubes,” International Journal of Advanced Manufacturing Technology. Vol. 91, 2135–2142. (SCI, EI)
6. **Y.M. Hwang** and Y.H. Lin, 2017, “Plastic Flow Analysis in Hot Aluminum Extrusion of Asymmetric Parts,” Materials Science Forum, Vol. 904, 50-54. (EI)
7. Gow-Yi Tzou, **Yeong-Maw Hwang**, Sai-Chih Pan, 2017, “Analytical Approach to Rotating Compression of a Porous Cylinder Considering Constant Shear Friction,” Transactions- Canadian Society for Mechanical Engineering 41(4):571-580. (SCI, EI)
8. **Y.M. Hwang**, K.S. Jhuang and H.C. Yu, 2018, “Finite Element Simulation of Rotating Compression Forming,” Materials Science Forum, Vol. 920, 22-27. (EI)
9. **Y.M. Hwang**, D.S. Lin and S.L. Lin, 2018, “Geometric Design of Rectangular Cross-Sectional Springs,” Materials Science Forum, Vol. 920, 126-131. (EI)
10. M.L. Wu, S.Y. Chiou, **Y.M. Hwang\***, 2018, “Empirical Equations for Optimization Conditions in Thermal Compression Bonding of Copper Pillar Flip Chip Packages,” Transactions on Components, Packaging and Manufacturing Technology, Vol. 8, No. 6, 1116-1120. (SCI, EI)
11. **Y.M. Hwang**, C.T. Pan, Y.X. Lu, S.R. Jian, and J.Y. Juang, 2018, “Deformation behaviors of Au nanotubes under torsion by molecular dynamics simulations,” AIP ADVANCES 8, 085204. (SCIE)



12. **Y.M. Hwang**, G.W. Kuo, H.H. Liu, 2018, “High temperature oxidation behavior in dieless drawing of titanium alloy wires,” *Procedia Manufacturing*, Vol.15, 294-301. (EI)
13. **Y.M. Hwang**, B.H. Chen, 2018, “Heading process design of titanium alloy dental screws,” *IOP Conf. Series: Journal of Physics: Conf. Series* Vol. 1074 (2018) 012177, doi:10.1088/1742-6596/1074/1/012177, pp. 1-7. (EI)
14. **Y.M. Hwang**, C.T. Pan, Y.M. Lin, S.W. Zeng, C.K. Yen, S.Y. Wang, S.W. Kuo, S.P. Ju, S.S. Liang, Z.H. Liu, 2019, Preparation of Biodegradable Polycaprolactone Microcarriers with Doxorubicin Hydrochloride by Ultrasonic-assisted Emulsification Technology,” *Sensors and Materials*, Vol. 31, No. 2, 301–310. (SCIE)
15. **Y.M. Hwang** and Y.L. Wang, 2019 “Microstructures and Mechanical Properties of Magnesium Alloy ZK60 Sheets after Multi-Pass Hot Rolling,” *Key Engineering Materials*, Vol. 794, 113-120. (EI)
16. C.T. Pan, **Y.M. Hwang**, Y.M. Lin, S.W. Zeng, S.Y. Wang, S.W. Kuo, S.P. Ju, S.S. Liang, Z.H. Liu, C.K. Yen, 2019, Developmemnt of Polycaprolactone Microspheres with Controllable and Uniform Particle Size by Uniform Design Experiment in Emulsion Process,” *Sensors and Materials*, Vol. 31, No. 2, 311–318. (SCIE)
17. **Y.M. Hwang** and H.H. Liu, 2019, “Formability Analysis and Oxidation Layer Effects in Dieless Drawing of Stainless Steel Wires,” *Metals* **2019**, 9(8), 828; <https://doi.org/10.3390/met9080828>. (SCIE)
18. C.T. Pan, C.K. Yen, S.Y. Wang, P.Y. Sun, S.Y. Huang, Z.H. Liu, **Y.M. Hwang**, L.M. Chu, Z.Y. Hoe\*, 2019, “A misalignment optical guiding module for power generation enhancement of fixed-type photovoltaic systems,” *micromachines*, *10*, 687; doi:10.3390/mi10100687. (SCIE)
19. E. Lyamina, A. Pirumov and **Y.M. Hwang**, 2020 “An Approach for Predicting the Initiation of Ductile Fracture in Plane Strain Rolling,” *Key Engineering Materials*, Vol. 827, 379-384. (EI)
20. **Y.M. Hwang**, S.L. Lin, and Z.Z. Xu, 2020 “Finite Element Analysis of Tube End Forming and Process Design,” *Key Engineering Materials*, Vol. 830, 69-76. (EI)
21. **Y.M. Hwang**, C.T. Pan, Y.X. Lu, S.R. Jian\*, H.W. Chang and J.Y. Juang, 2020, “Influence of Post-Annealing on the Structural and Nanomechanical Properties of Co Thin Films,” *micromachines*, *11*, 180; doi:10.3390/mi11020180. (SCIE)
22. **Y.M. Hwang**, W.H. Dai and C.C. Chen, 2020, “Investigation of punch shape design in tube hydro-piercing processes,” *International Journal of Advanced Manufacturing Technology*, Vol. 110, 2211-2220. (SCIE)
23. **Y.M. Hwang**, C.T. Pan, B.S. Chen, P.H. Le, N.N. Uyen, L.T.C. Tuyen, V. Nguyen, C.W. Luo, J.Y. Juang, J. Leu and S.R. Jian\*, 2020, “Effects of Stoichiometry on Structural, Morphological and Nanomechanical Properties of Bi<sub>2</sub>Se<sub>3</sub> Thin Films Deposited on InP(111) Substrates by Pulsed Laser Deposition,” *Coatings* *10*, 958; doi:10.3390/coatings10100958 (SCIE)
24. **Y.M. Hwang\*** and C.C. Chen, 2020, “Investigation of Effects of Strip Metals and Relative Sliding Speeds on Friction Coefficients by Reversible Strip Friction Tests,” *Metals* **2020**, *10*, 1369; doi:10.3390/met10101369. (SCIE)
25. **Y.M. Hwang\*** and Y.J. Tsai, 2020, “Movable Die and Loading Path Design in Tube Hydroforming of Irregular Bellows,” *Metals* **2020**, *10*, 1518; doi:10.3390/met10111518. (SCIE)
26. S. Alexandrov, E. Lyamina and **Y.M. Hwang\***, 2021, “Finite Pure Plane Strain Bending of Inhomogeneous Anisotropic Sheets,” *Symmetry* **2021**, *13*, 145. <https://doi.org/10.3390/sym13010145>. (SCIE)
27. Y.T. Lin\*, C.Y. Tseng, J.H. Kuang and **Y.M. Hwang**, 2021, “A Design Method for a Variable Combined Brake System for Motorcycles Applying the Adaptive Control Method,” *Machines* **2021**, *9*, 31. <https://doi.org/10.3390/machines9020031>. (SCIE)



28. S. Alexandrov, E. Lyamina and **Y.M. Hwang\***, 2021, "Plastic Bending at Large Strain: A Review," *Processes* 2021, 9, 406. <https://doi.org/10.3390/pr9030406>. (SCIE)
29. **Y.M. Hwang**, C.T. Pan, B.S. Chen, S.R. Jian\*, 2021, "Numerical Analysis of the Welding Behaviors in Micro-Copper Bumps," *Metals* 2021, 11, 460. <https://doi.org/10.3390/met11030460>. (SCIE)
30. **Y.M. Hwang\*** H.N. Pham and H.S.R. Tsui, 2021, "Investigation of Punch Shape and Loading Path Design in Hydro-Flanging Processes of Aluminum Alloy Tubes," *Metals* 2021, 11, 636. <https://doi.org/10.3390/met11040636>. (SCIE)
31. Y.T. Lin\*, C.Y. Tseng, J.H. Kuang and **Y.M. Hwang**, 2021, "Design of combined brake system for light weight scooters," *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*. 2021, June, 9. <https://doi.org/10.1177/095440702111024093>. (SCIE)
32. **Y.M. Hwang\*** and Ken-Ichi Manabe, 2021, "Latest Hydroforming Technology of Metallic Tubes and Sheets," *Metals* 2021, 11, 1360. <https://doi.org/10.3390/met11091360>. (SCIE)
33. George H. Cheng, G. Gary Wang, **Y.M. Hwang**, 2021, "Multi-Objective Optimization for High-Dimensional Expensively Constrained Black-Box Problems," *J. Mech. Des.* Nov 2021, 143(11): 111704 (17 pages) Paper No: MD-20-1858 <https://doi.org/10.1115/1.4050749> (SCIE)
34. **Y.M. Hwang\***, M.R. Lin, CH Wu, H.S.R. Tsui, 2021, "Finite Element Analysis of Cold Drawing of Stainless Steel Bars," *Journal of Physics: Conference Series*. 2020 (2021) 012021, doi:10.1088/1742-6596/2020/1/012021. (EI)
35. S. Alexandrov, E. Lyamina and **Y.M. Hwang\***, 2021, "An Efficient Method of Calculating the Force and Torque in the Upsetting of Cylinders with Rotating Dies," *Processes* 2021, 9, 1845. <https://doi.org/10.3390/pr9101845> (SCIE)