

## **Peng ZHANG**

Associate Professor

Department of Mechanical Engineering

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### **Education**

- |      |   |
|------|---|
| 2010 | Ph.D. in Mechanical and Aerospace Engineering<br>Princeton University                 |
| 2003 | M.Sc. in Aerospace Engineering<br>Institute of Mechanics, Chinese Academy of Sciences |
| 2000 | B.Sc. in Mechanical Engineering<br>University of Science and Technology of China      |

### **Employment**

- |              |   |
|--------------|---|
| 2012-present | Associate Professor (2017-present), Assistant Professor (2012-2017)<br>Department of Mechanical Engineering<br>The Hong Kong Polytechnic University |
| 2010-2012    | Combustion Energy Research Fellow<br>Combustion Energy Frontier Research Center of U.S. Department of Energy<br>Princeton University                |
| 2010         | Postdoctoral Research Associate<br>Department of Mechanical and Aerospace Engineering<br>Princeton University                                       |
| 2003-2004    | Research Staff<br>Institute of Mechanics, Chinese Academy of Sciences   |

### **Research Interests**

Droplet and spray dynamics; Theoretical chemical kinetics; Supersonic combustion; Fire whirl;  
Gas-turbine combustion; Rarefied gas dynamics

## Honors and Awards

- 2017 Guest Professor  
State Key Laboratory of High-temperature Gas Dynamics, Chinese Academy of Sciences
- 2016 Research Grant Achievement Award  
Faculty of Engineering, The Hong Kong Polytechnic University
- 2014 The Appreciation of Research Achievement  
Committee of Science and Technology of Innovation of Shenzhen
- 2010 Combustion Energy Research Fellowship  
Princeton University
- 2008 Wu Prize for Excellence  
Princeton University
- 2004 Yongling Liu Fellowship  
Chinese Academy of Sciences
- 2002 Yung-Huai Kuo Fellowship  
Institute of Mechanics, Chinese Academy of Sciences
- 2000 Best Senior Thesis Prize  
University of Science and Technology of China

## Teaching

- |         |  |                                      |
|---------|--|--------------------------------------|
| AP10005 | Physics I                                | (2013-2014, Fall Semester)           |
| ME3403  | Advanced Engineering Science in Products | (2012-2015, Fall & Spring Semesters) |
| ME3407  | Fluid Mechanics                          | (2012-2014, Fall & Spring Semesters) |
| ME34004 | Fluid Mechanics                          | (2014-2015, Spring Semester)         |
| ME4409  | Engine Technology                        | (2013-2015, Fall & Spring Semesters) |
| ME44003 | Combustion and Pollution Control         | (2017-present, Spring Semester)      |
| ME47007 | Aircraft and Spacecraft Propulsion       | (2018-present, Fall Semester)        |
| ME556   | Advanced Combustion Systems              | (2014-Present, Fall/Spring Semester) |
| ME576   | Turbulent Flow and Aerodynamics          | (2014-Present, Spring Semester)      |
| ME6401  | Combustion Science                       | (2014-Present, Fall Semester)        |

## **Professional Society Membership**

Member of Combustion Institute

Senior member AIAA

Member of Chinese Chemistry Society

Member of American Physics Society

## **Academic Services**

### **Conference Session Chair**

1. 2018 China National Symposium on Combustion
2. The 13<sup>th</sup> International Conference on Combustion & Energy Utilization, Taipei, 2016
3. The 10th Asia-Pacific Conference on Combustion, Beijing, 2015
4. The 4th East Asia Mechanical and Aerospace Engineering Workshop, the Hong Kong Polytechnic University, 2014
5. Fall Technical Meeting Eastern States Section of the Combustion Institute, University of Connecticut, 2011

### **Reviewer**

- Journals in Physics: Journal of Fluid Mechanics, Physics of Fluid, Scientific Reports, Journal of Colloid and Interface Science
- Journals in Chemistry: Journal of Physical Chemistry, International Journal of Chemical Kinetics
- Journals in Mechanical Engineering: Combustion and Flame, Proceedings of Combustion Institute, Combustion Science and Technology, International Journal of Heat and Mass Transfer, Energy Conversion and Management, European Journal of Mechanics -B/Fluids, International Journal of Multiphase Flow, Energy and Fuel, Journal of Thermal Analysis and Calorimetry., AIChE Journal.
- Journals in Aerospace Engineering: AIAA Journal, Journal of Propulsion and Power, Journal of Aerospace Engineering, Shock Waves
- Conferences: AIAA, ASME, ASPACC, ISAAC-NL, Chinese National Combustion Meeting
- Funding Agencies: Research Council of Norway, U.S. Department of Energy

## Journal Publications (Accepted or under Review; Corresponding Author \*)

1. Q. Meng, Y. Chi, L. Zhang and **P. Zhang\***, *A theoretical kinetics study on isomerization and dissociation reactions of methyl decanoate radicals*, Physical Chemistry and Chemical Physics (under review)
2. T. Yang, X. Xia and **P. Zhang\***, *Anti-phase and In-phase Flickering of Dual Pool Flames*, Physical Review E (under review)
3. D. Yu, H. Gu, and **P. Zhang\***, *An energy integral analysis of compressible axisymmetric jets with external periodic forcing*. International Journal of Heat and Fluid Flow (under review)
4. Z. Zhang, **P. Zhang\*** and Z. Zhao, *Cross-Impingement and Combustion of Sprays in High-Pressure Chamber and Opposed-piston Compression Ignition Engine*, Applied Thermal Engineering (under review)
5. Z. Zhang and **P. Zhang\***, *Modelling kinetic energy dissipation of bouncing droplets for Lagrangian simulation of impinging sprays under high ambient pressures*, Spray and Atomization (under review)
6. D. Zhang, C. He, **P. Zhang\*** and C. Tang, *Mass Interminglement and Hypergolic Ignition of TMEDA and WFNA Droplets by Off-center Collision*, Combustion and Flame (under review)
7. X. Zhu, X. Xia and **P. Zhang\***, *Stability of Buoyant Inverse Diffusion Methane Flames with Confinement Effects*, Combustion and Flame (under review)
8. Y. Li, **P. Zhang\***, N. Kang and F. Liu, *Rayleigh-Taylor instability on a spherical droplet with nonradial disturbances*, Journal of Mathematical Physics (under review)
9. Y. Li\*, **P. Zhang\*** and N. Kang, *Linear Faraday instability on a viscous droplet immersed in another inviscid fluid*, Physical Review Fluids (under review)
10. X. Xia, C. He and **P. Zhang\***, *Scalings in Coalescence of Liquid Droplets*, Physical Review Letters (under review)
11. X. Xia and **P. Zhang\***, *A vortex-dynamical scaling theory for flickering buoyant diffusion flames*, Journal of Fluid Mechanics (under review)
12. D. Zhang, D. Yu, Y. Yuan, L. Yue, **P. Zhang\***, T. Zhang and X. Fan, *Hypergolic ignition by head-on collision of TMEDA and WFNA droplets: size effects on multiple time scales*, 37<sup>th</sup> International Symposium on Combustion (accepted)
13. K. Wu, **P. Zhang\***, W. Yao\* and X. Fan, *Computational realization of multiple flame stabilization modes in DLR strut-injection hydrogen supersonic combustor*, 37<sup>th</sup> International Symposium on Combustion (accepted)

## Journal Publications (Published or in Press; Corresponding Author \*)

### 2018

1. L. Zhang, Q. Meng, Y. Chi and **P. Zhang\***, *Toward High-Level Theoretical Studies of Large Biodiesel Molecules: An ONIOM [QCISD(T)/CBS:DFT] Study of the Reactions between Unsaturated Methyl Esters ( $C_nH_{2n-1}COOCH_3$ ) and Hydrogen Radical*. Journal of Physical Chemistry A, **122** (2018) 4882-4893.
2. Q. Meng, X. Zhao, L. Zhang\*, **P. Zhang\***, and L. Sheng, *A theoretical kinetics study on low-temperature reactions of methyl acetate radicals with molecular oxygen*. Combustion and Flame, **196** (2018) 66-75.
3. X. Zhu, X. Xia, and **P. Zhang\***, *Near-field Flow Stability of Buoyant Methane/Air Inverse Diffusion Flames*. Combustion and Flame, **191** (2018) 66-75.
4. D. Yu and **P. Zhang\***, *Circulation-controlled firewhirl with differential diffusion*. Combustion and Flame, **189** (2018) 288–299.
5. L.Y. Yue, Y. Jia, X. Xu, X. Zhang, and **P. Zhang**, *Effects of Cowl Shock on the Self-starting Characteristics of Hypersonic Inlets*. Aerospace Science and Technology, **74** (2018) 72-80.
6. K. Sun, **P. Zhang**, Z. Che, and T. Wang, *Marangoni-flow-induced partial coalescence of a droplet on a liquid/air interface*. Physical Review Fluids **3**, 023602 (2018).
7. K. Sun, **P. Zhang\***, M. Jia, and T. Wang, *Collision-induced jet-like mixing for droplets of unequal-sizes*. International Journal of Heat and Mass Transfer, **120** (2018) 218-227.

### 2017

8. X. Xia, C. He, J. Zhao, D. Yu, and **P. Zhang\***, *Vortex-Ring-Induced Internal Mixing Upon the Coalescence of Initially Stationary Droplets*. Physical Review Fluids, **2**, 113607 (2017).
9. Z. Zhang and **P. Zhang\***, *Kinetic Energy Recovery and Interface Hysteresis of Bouncing Droplets after Inelastic Head-on Collision*, Physics of Fluids, 2017. **29**, 103306.
10. K. Wu, **P. Zhang\***, W. Yao, and X. Fan, *Numerical Investigation on Flame Stabilization in DLR Hydrogen Supersonic Combustor with Strut Injection*. Combustion Science and Technology, 2017. **189**(12): p. 2154-2179.
11. Z. Zhang, **P. Zhang\***, and Z. Zhao, *Impingement and Combustion of Sprays in a Model Opposed-Piston Compression Ignition Engine*. Combustion Science and Technology, 2017. **189**(11): p.1943-1965.

12. C. Tang, X. Zhang, L. Song, M. Qin, **P. Zhang**, J. Li and Z. Huang, *Dynamics of droplet impact on solid surface with hierarchical roughness*. International Journal of Multiphase Flows, **96**: p. 56–69.
13. D. Yu and **P. Zhang\***, *On the flame height of circulation-controlled firewhirl with variable density and in power-law vortices: a mass-diffusivity-ratio model correction*. Combustion and Flame, 2017. **182**: p. 36–47.
14. D. Yu and **P. Zhang\***, *On the flame height of circulation-controlled firewhirls with variable density*. Proceedings of the Combustion Institute, 2017. **36**(2): p. 3097-3104.
15. Y. Yuan, T. Zhang, W. Yao, X. Fan\*, and **P. Zhang**, *Characterization of flame stabilization modes in an ethylene-fueled supersonic combustor using time-resolved CH\* chemiluminescence*. Proceedings of the Combustion Institute, 2017. **36**(2): p. 2919-2925.
16. L. Shi, H. Shen, **P. Zhang**, D. Zhang, and C. Wen, *Assessment of vibrational non-equilibrium effect on detonation cell size*. Combustion Science and Technology, 2017. **189**(5): p. 841-853.

## 2016

17. C.L. Tang, J.Q. Zhao, **P. Zhang\***, C.K. Law\*, and Z.H. Huang, *Dynamics of internal jets in the merging of two droplets of unequal sizes*. Journal of Fluid Mechanics, 2016. **795**: p. 671-689.
18. Z. Zhang, Y. Chi, L. Shang, **P. Zhang\***, and Z. Zhao, *On the role of droplet bouncing in modeling impinging sprays under elevated pressures*. International Journal of Heat and Mass Transfer, 2016. **102**: p. 657-668.
19. D. Zhang, **P. Zhang\***, Y. Yuan, and T. Zhang, *Hypergolic Ignition by Head-on Collision of N,N,N',N'-tetramethylethylenediamine and White Fuming Nitric Acid Droplets*. Combustion and Flame, 2016. **173**: p. 276-287.

## 2015

20. K. Sun, **P. Zhang\***, C.K. Law\*, and T.Y. Wang, *Collision Dynamics and Internal Mixing of Droplets of Non-Newtonian Liquids*. Physical Review Applied, 2015. **4**(5).
21. K. Sun, T.Y. Wang, **P. Zhang\***, and C.K. Law, *Non-Newtonian flow effects on the coalescence and mixing of initially stationary droplets of shear-thinning fluids*. Physical Review E, 2015. **91**(2).
22. **P. Zhang\***, L.D. Zhang, and C.K. Law, *Density functional theory study of the reactions of 2-azido-N,N-dimethylethanamine with nitric acid and nitrogen dioxide*. Combustion and Flame, 2015. **162**(1): p. 237-248.

23. X.R. Zhu, R.F. Li\*, D.G. Li\*, **P. Zhang\***, and R.Z. Qian, *Experimental study and RANS calculation on velocity and temperature of a kerosene-fueled swirl laboratory combustor with and without centerbody air injection*. International Journal of Heat and Mass Transfer, 2015. **89**: p. 964-976.
24. Y.C. Li, R.F. Li\*, D.G. Li\*, J.Y. Bao, and **P. Zhang\***, *Combustion characteristics of a slotted swirl combustor: An experimental test and numerical validation*. International Communications in Heat and Mass Transfer, 2015. **66**: p. 140-147.
25. L.D. Zhang and **P. Zhang\***, *Towards high-level theoretical studies of large biodiesel molecules: an ONIOM [QCISD(T)/CBS:DFT] study of hydrogen abstraction reactions of  $C_nH_{2n+1}COOC_mH_{2m+1} + H$* . Physical Chemistry Chemical Physics, 2015. **17**(1): p. 200-208.
26. L.D. Zhang, Q.X. Chen, and **P. Zhang\***, *A theoretical kinetics study of the reactions of methylbutanoate with hydrogen and hydroxyl radicals*. Proceedings of the Combustion Institute, 2015. **35**: p. 481-489.

## 2014

27. **P. Zhang\***, S.J. Klippenstein\*, L.B. Harding, H.Y. Sun, and C.K. Law, *Secondary channels in the thermal decomposition of monomethylhydrazine ( $CH_3NHNH_2$ )*. RSC Advances, 2014. **4**(108): p. 62951-62964.
28. T.C. Zhang, J. Wang, X.J. Fan\*, and **P. Zhang**, *Combustion of Vaporized Kerosene in Supersonic Model Combustors with Dislocated Dual Cavities*. Journal of Propulsion and Power, 2014. **30**(5): p. 1152-1160.
29. T.C. Zhang, J. Wang, L. Qi, X. Fan\*, and **P. Zhang**, *Blowout Limits of Cavity-Stabilized Flame of Supercritical Kerosene in Supersonic Combustors*. Journal of Propulsion and Power, 2014. **30**(5): p. 1161-1166.

## 2013

30. **P. Zhang**, S.J. Klippenstein\*, and C.K. Law, *Ab Initio Kinetics for the Decomposition of Hydroxybutyl and Butoxy Radicals of n-Butanol*. Journal of Physical Chemistry A, 2013. **117**(9): p. 1890-1906.
31. D. Liu, **P. Zhang\***, C.K. Law, and Y.C. Guo, *Collision dynamics and mixing of unequal-size droplets*. International Journal of Heat and Mass Transfer, 2013. **57**(1): p. 421-428.

## Before 2013

32. H.Y. Sun, **P. Zhang**, and C.K. Law, *Ab Initio Kinetics for Thermal Decomposition of  $CH_3N\cdot NH_2$ , cis- $CH_3NHN\cdot H$ , trans- $CH_3NHN\cdot H$ , and  $C\cdot H_2NNH_2$  Radicals*. Journal of Physical Chemistry A, 2012. **116**(33): p. 8419-8430.

33. H.Y. Sun, **P. Zhang**, and C.K. Law, *Gas-Phase Kinetics Study of Reaction of OH Radical with  $CH_3NHNH_2$  by Second-Order Multireference Perturbation Theory*. Journal of Physical Chemistry A, 2012. **116**(21): p. 5045-5056.
34. S.W. Yoo, S. Chaudhuri, K.R. Sacksteder, **P. Zhang**, D.L. Zhu, and C.K. Law, *Response of spherical diffusion flames subjected to rotation: Microgravity experimentation and computational simulation*. Combustion and Flame, 2012. **159**(2): p. 665-672.
35. C. Tang, **P. Zhang**, and C.K. Law, *Bouncing, coalescence, and separation in head-on collision of unequal-size droplets*. Physics of Fluids, 2012. **24**(2).
36. **P. Zhang** and C.K. Law, *An analysis of head-on droplet collision with large deformation in gaseous medium*. Physics of Fluids, 2011. **23**(4).
37. **P. Zhang** and C.K. Law, *A Fitting Formula for the Falloff Curves of Unimolecular Reactions, II: Tunneling Effects*. International Journal of Chemical Kinetics, 2011. **43**(1): p. 31-42.
38. **P. Zhang**, S.J. Klippenstein, H.Y. Sun, and C.K. Law, *Ab initio kinetics for the decomposition of monomethylhydrazine ( $CH_3NHNH_2$ )*. Proceedings of the Combustion Institute, 2011. **33**: p. 425-432.
39. **P. Zhang** and C.K. Law, *Rarefied flow effects on stabilization and extinction of rotating-disk flame at low pressures*. International Journal of Heat and Mass Transfer, 2010. **53**(1-3): p. 475-481.
40. T.C. Zhang, **P. Zhang**, C.K. Law, and F. Qi, *CVD in Weakly Rarefied Rotating Disk Flows*. Chemical Vapor Deposition, 2009. **15**(10-12): p. 274-280.
41. **P. Zhang** and C.K. Law, *A Fitting Formula for the Falloff Curves of Unimolecular Reactions*. International Journal of Chemical Kinetics, 2009. **41**(11): p. 727-734.
42. **P. Zhang** and C.K. Law, *Role of the Knudsen layer in determining surface reaction rates based on sticking coefficients*. Journal of Fluid Mechanics, 2009. **634**: p. 113-135.

#### Journal Publications (in Chinese)

43. **P. Zhang**, *Binary Droplet Collision in Gaseous Environment*. SCIENCE CHINA Physics, Mechanics & Astronomy, 2017. 47(7): 070013. (invited review paper).
44. **P. Zhang** and G. Yu, *Rayleigh-Taylor instability of a liquid drop at high Bond numbers*. Chinese Journal of Theoretical and Applied Mechanics, 2006. **38**(3): p. 1-7.
45. Y. Zhang, M. Zhang, S. Xu, and **P. Zhang**, *Numerical investigation on blast wave propagation and dynamic response of an explosion vessel*. Explosion and Shock Waves, 2003. **23**(4): p. 331-336.

46. **P. Zhang** and G. Yu, *Study of one-dimensional flow analysis model of the combustor in supersonic combustion experiments*. Experiments and Measurements in Fluid Mechanics 2003. **17**(1): p. 88-92.
47. P. Yue, S. Xu, and **P. Zhang**, *Numerical study on a moving shock diffracted over the cylinder/square column in hydrogen air mixture*. Chinese Journal of Computational Physics, 2001. **18**(1): p. 10-16.

#### **Patent (in China)**

1. R. Li, **P. Zhang**, R. Qian, J. Bao, X. Zhu, L. Ma, and B. Li, *An Axial Swirler with Center Flow Injectors*. Chinese Patent number: ZL 2013 2 0727294.9, 2013: P. R. China.