



## DAFTAR PUSTAKA

- Araki K. dan Moriyama A., 1981,*Theory on Deformation of A liquid Droplet Impinging onto Hot Metal Surface*. Transactions ISIJ, Vol. 21 , pp 583-590.
- Atkinson, J.,1993, *Elementary Numerical Analysis*, second edition, John Wiley & Sons, Inc, New York,
- Bannett, T and Poulikakos.D.,1993*Splat-quench solidification: estimating the maximum speading of a droplet impacting a solid surface*, J. Mater.Sci, vol 28,963-970.
- Bernardin dan Mudawar,1999,*The Leidenfrost Point: Experimental Study and Assessment of Existing Models*, Transaction of ASME,Vol.121,pp 894-903.
- Bernardin,J.D.,Mudawar,I.dkk,, 1997.A, *Contact Angle Temperature Depedence for Water Droplets on Practical Aluminum Surfaces*. Int. J. Heat Mass Transfer, Vol. 40, No.5, pp 1017-1033.
- Brian, B., 2006, *a Friendly Introduction to Numerical Analysis*, Pearson Prestice Hill, United State of America.
- Burggraf, O.R., 1966, *Analytical and Numerical Studies of the Structure of Steady Separated Flows*, Journal of Fluid Mechanics, 966, 24, 113–151.
- C.Batty, Simulating Viscous Incompressible Fluids with Embedded Boundary Finite Difference
- Cengel, Y.2003, *Heat Transfer: A practical Approach 2nd Edition*. New York: Mc Graw Hill.
- Chandra S., Di Marzo, M., dkk, 1996, *Effect of liquid – solid contact angle on droplet evaporation*, Fire Safety Journal, 27, pp 141-158.
- Chandra, S.and Avedisian, C.T,1991, *On the collision of a droplet with a solid surface*, Proc. R. Soc. Lond.A, vol 432,13-41.
- Ciafalo, M., Caronia, A., dkk, 2007, *The Nukiyama curve in water spray cooling: In derivativation from temperature-time histories and its dependence on the quantities that characterize drop impact*, Int.J. Heat and Mass Transfer.
- Clanet, C., et al., 2004, Maximal deformation of an impacting drop, *Journal of Fluid Mechanics* 517, 199–208.
- Dalmaz, N.Z., 2005, *Modeling and Numerical Analysis of Single Droplet Drying*, Disertasi, Middle East Technical University.
- Deendarlianto, Y. Takata, S. Hidaka, M Kohno, *The Effect of Contact Angle on the Evaporation of Water Droplet on Heated Solid Surface*. Fifth Int. Conference on Transport Phenomena In Multiphase Systems, pp. pp 59 – 64. Bialystok – Poland. 2008
- Deendarlianto, et al., 2014, *Effect of static contact angle on the droplet dynamics during the evaporation of a water droplet on the hot walls*, International Journal of Heat dan Mass Transfer, 71, 691–705.
- Deendarlianto. et al, 2016, *The effects of the surface roughness on the dynamic behavior of the successive micrometric droplets impacting onto inclined hot surfaces*. International Journal of Heat dan Mass Transfer, 101, 1217–1226.
- Deendarlianto, et al., 2018, *The interfacial dynamics of the micrometric droplet diameters during the impacting onto inclined hot surfaces*, International Journal of Heat dan Mass Transfer 126, 39–51.



- Erturk, E., Corke, T.C., Gokcol, C., 2005. *Numerical solutions of 2-D steady incompressible driven cavity flow at high Reynolds numbers*, International Journal for Numerical Methods in Fluids, 48, 747-774.
- Fard Pasandideh, M., Aziz, SD., dkk, 2000, *Cooling effectiveness of a water drop impinging on a hot surface*, Int. J. of Heat and Fluid Flow 22, pp 201-271.
- Fujimoto, H., Takezaki, I. dkk, 2004, *Collision dynamics of two droplets impinging successively on to a hot solid*, ISIJ International, Vol 44, pp 1049-1056.
- Fujimoto H., et al., 2004, *Entrapment of at 45 degree oblique collision of a water drop with a smooth solid surface at room temperature*, International Journal of Heat and Mass Transfer 47, 3301-3305.
- Fujimoto H., et al., 2008, *Interaction phenomena of two water droplets successively impacting onto a solid surface*. Int. J. Therm. Sci. 47, 229–236.
- Fukai, J., Poelikakos, D., 1995, *Wetting effects on spreading of a liquid droplet colliding with a flat surface: Experiment and modeling*, Articles, Journal Phys. Fluids 7 (2).
- Ghia, U. Ghia, K.N., Shin, C.T., 1982. *High-Re solutions for incompressible ilow using the Navier-Stokes equations and a multigrid method*, Journal of Computational Physics, 48, 387-411.
- Gerhart, Philip, M., 1985, *Fundamentals of Fluid Mechanics*, Addison-Wesley Publishing Company.
- Gokhale, S, J, PlawskJ., Peter, C.L.W.Jr., 2002, *Experimental Investigation of Contact Angle, Curvature, and Contact line Motion in Dropwise Condensation and Evaporation*, Journal Colloid and Interface Science, vol. 259, 354-366.
- Harlow F.H, Shannon.J.P., *The splash of a liquid droplet*. Journal of Applied Physics, 1967, 38(10):3855-3866.
- Harlow, F., and Welch, J., 1965, *Numerical calculation of time-dependent viscous incompressible flow of fluid with free surface*, The Physics of Fluids, 8 (1965), p. 2182.
- Hatta, N. et al., 1997, Experimental study of deformation mechanism of a water droplet impinging on hot metallic surfaces above the Leidenfrost temperature: (Data bank contribution), *J. Fluids Eng.* 119, 692–699.
- Humi, M, 1991, *Boundary Value Problem and Partial Differential Equations*, PWS-KENT Publishing Company, Boston.
- Izbassarov.D, Muradoglu.M, *A Front-tracking method for computational modeling of viscoelastic two-phase flow systems*, J. of Non-newtonian fluid Mech., 223 (2015) 122-140.
- Jia, W., dan Qiu, H. H., 2003, *Experimental Investigation of Droplet Dynamics and Heat Transfer in Spray cooling*. Experimental Thermal and Fluid Science 27 , pp 829 – 838.
- Kalita, J.C., Gupta, M.M., 2010, A streamfunction-velocity approach for 2D transient incompressible viscous flows, *International Journal for Numerical Methods in Fluids*, 62, 237–266.
- Kao Po-Hao, R.Yang. , *A Segregated-implicit Scheme for Solving the Incompressible Navier Stokes Equations*, Computer and Fluid, 36 (2007) p1159-1161
- Kandlikar, S.G. dan Steinke, M.E., *Contact Angle of Droplets During Spread and Recoil After Impinging on a Heated Surface*, Trans Icheme, vol. 79, Part A, pp 491-498, 2001.



- Karl, A., Anders, K., dkk, 1996, *Deformation of Liquid Droplets During Collisions with Hot walls: Experimental and Numerical Results*, Part Part Syst Charact 13, pp 186-191.
- Kelly, J.M., Divo, E.A., Kassab, A.J., 2014. *Numerical simulation of the two-phase incompressible Navier-Stokes equations using a GPU-accelerated meshless method*, Engineering Analysis with Boundary Element, 40, 36-49.
- Khatavkar VV, Anderson PD, Duinveld PC, Meijer HEH. *Diffuse-interface modeling of droplet impact*. J. Fluid Mech. 2007;581:97–127.
- Liu, H., 2000, *Science dan Engineering of Droplets Fundamentals dan Applications*. William Danrew Publishing, Norwich, New York, U.S.A pp. 217.
- LeVeque,R.J, *Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems*, SIAM, Philadelphia. (2007)
- Lunkad, S.F., Buwa, V.V., Nigam, K.D.P., 2007. *Numerical simulations of drop impact and spreading on horizontal and inclined surfaces*. Chem. Eng. Sci. 62 (24), 7214–7224
- Makino, K.Michiyoshi. I., 1979, *Effect of The Initial Size of Water Droplet On Its Evaporation On Heated Surface*, Int, J, Heat Mass Transfer, vol 22, 979-981.
- Michiyoshi, I., Makino, K., 1977, *Heat Transfer Characteristic of Evaporation of a Liquid Droplet on Heated Surface*, Int. J. Heat Mass Transfer, Vol. 21,605-613.
- Mitrakusuma, WH.,2013, *Studi Komprehensif Mengenai Pengaruh Wettability (Derajat Kebasahan) Terhadap Fenomena Critical Heat Flux Selama Proses Spray Cooling*.
- Mukherjee A,Kandlikar S.G.,2007,*Numerical Study of Single Bubbles with Dynamics Contact Angle During Nucleate Pool Boiling*.Int.Journal of Heat and Mass Transfer 50,pp127– 138.
- M.Muradoglu ,S.Tasoglu ,2009, *A front-tracking method for computational modeling of impact and spreading of viscous droplets on solid walls* ,Department of Mechanical Engineering, Koc University Rumelifeneri Yolu, Sariyer 34450, Istanbul,Turkey Computers & Fluids journal homepage: [www.elsevier.com/locate/compfluid](http://www.elsevier.com/locate/compfluid) Article history: Received 29
- Najafi, M., Enjilela, V., 2014. *Natural convection heat transfer at high Rayleigh numbers-Extended meshless local Petrov-Galerkin (MLPG) primitive variable method*, Engineering Analysis with Boundary Elements, 44, 170-184.
- Naoki Takada And Akio Tomiyama, 2006, *A Numerical Method for Two-PhaseFlow Based on a Phase-Field Model*, Jsme International Journal Series B
- Negeed, E.R., et al., 2013, *Effect of the surface roughness dan oxidation layer on the dynamic behavior of micrometric single water droplets impacting onto heated surfaces*, International Journal of Thermal Sciences, 70, 65-82.
- Nilsson, F., 2004, *Numerical Treatment of a Diffusion-Connection-Evaporation Model for Droplets*, KTH Numerical Analysis and Computer.
- N.Rusli, E. H. Kasiman, A. K. B. Hong, A. Y. M. Yassin, N. Amin, *Numerical Computation of a Two-Dimensional Navier-Stokes Equation Using an Improved Finite Difference Method*, Journal of Mathematics UTM, 27 (2011) 1-9.
- Patankar, S.V., 1980, *Numerical Heat Transfer and Fluid Flow*, Mc Graw-Hill, New York Compamy.



- J. B. Perot & R. Nallapati (2003), Modeling return-to-isotropy using kinetic equations, Submitted to Physics of Fluids..
- Peskin, C.S., 1985, *A Random-Walk Interpretation of the Incompressible Navier-Stokes Equations. Pure and Applied Mathematics*, vol. XXXVIII (1985), p. 845-852
- Qiao, Y.M. dan Chdanra, S., 1997, *Experiments on adding a surfactant to water drops boiling on a hot surface*. Proceedings Royal Society London A, 453, pp 673-689.
- Quan, S., Lou, J., Schmidt, D.P., 2009, *Modeling merging and breakup in the moving mesh interface tracking method for multiphase flow simulations*. *J. Comput. Phys.*, 228 (2009), p. 2660-2675.
- Qystein, Myrmo., 2011, *Numerical Modelling of Pool Spreading, Heat Transfer and Evaporation in LNG*, Norwegian University of Science and Technology.
- Roberson and Crowe, 1990, *Engineering Fluid Mechanics*, Fourth Edition, Houghton Mifflin Company, Boston.
- Roisman, I.V., Rioboo, R., & Tropea, C., 2002, *Normal impact of a liquid drop on a dry surface: model for spreading and receding*, Proc. R. Soc. A Math. Phys. Eng. Sci. 458, 1411–1430.
- Rommy, 2009, Studi Eksperimental Dinamika Tetesan Tunggal yang Menimpa Permukaan Panas di Atas Wetting Limit Temperature pada Bilangan Weber Menengah, Tesis S2, Teknik Mesin – UGM.
- Ross, S. 1984, *Differential Equation*, Third Edition, John Wiley & Sons, New York.
- Rui Ma., X.Zhou, B.Dong , W. Li, J.Gong, 2018, *Simulation of impacting process of a saturated droplet upon inclined surfaces by lattice Boltzmann method*, Int. J. of Heat and Fluid Flow, 71, 1-2
- Senda J., K. Yamada, Fujimoto H., Miki H., 1988, *The Heat transfer Characteristics of a Small Droplet Impinging upon a Hot Surface*. JSME International Journal, Series II, Vol. 31, No. 1 , pp 105 – 111.
- S.G. Kandlikar and M. E. Steinke, 2001, *Contact Angles of Droplets During Spread And Recoil After Impinging on A Heated Surface*, Institution of Chemical Engineers Trans IChemE, Vol. 79, Part A
- Sheng- Li Quan, W.Z.Li,S.Quan Shen,Y.Li Guo, 2013, *Simulation of Droplet Impact onto Horizontal and Inclined Solid Surfaceswith Lattice-Boltzmann Method*, Journal of Harbin Institute of Technology, Vol 20, No.6
- Sikalo S., dkk., 2005, *Dynamic Wetting Angle of Spreading Droplet*. Experimental Thermal and Fluid Science 29, pp795– 802.
- Sikalo S., dkk., 2002, *Analysis of Impact of Droplets on Horizontal Surfaces*, Experimental Thermal and Fluid Science 25 , pp 503 – 510.
- Š. Šikalo, C. Tropea, E.N. Ganic', 2005, *Impact of droplets onto inclined surfaces* Journal of Colloid and Interface Science 286 , 661–669
- Š. Šikalo, C. Tropea, E.N. Ganic', 2005, *Dynamic wetting angle of a spreading droplet*, Experimental Thermal and Fluid Science 29, 795–802
- Stewart.J, 1999, *Calculus*, Fourth Edition, Brooks / Cole Publishing Company Adivision of International Thomson Publishing Inc.
- S.Unverdi, G.Tryggvason, *A front-tracking method for viscous, incompressible multifluids flow*, J. Comput. Phys., 100 (1992), pp. 25- 37.
- T. Kambe, *Elementary Fluid Mechanics*. World Scientific Publishing, Singapore. (2006)



- Tang, C., et al., 2017, *Dynamics of droplet impact on solid surface with different roughness*, International Journal of Multiphase Flow, 96, 56-69
- Thomas, L.C., 1992, *Heat Transfer*, Prentice Hall, Englewood Cliffs, New Jersey.
- Tong, W., Cohen B. A., Simon W.T., You S. M., 1990, *Contact Angle Effects on Boiling Incipience of Highly-Wetting Liquid*. *Int. J. Heat Mass Transfer*, Vol. 33. No. 1 , pp 91 – 103.
- Tong A.Y, Kasliwal S., Fujimoto H., 2007, *On the Successive Impingement of Droplets onto a Substrate*, *Numerical Heat Transfer, Part A: Applications: An International Journal of Computation and Methodology*.
- Tryggvason.G, *A Front-tracking/Finite-Volume Navier-Stokes Solver for Direct Numerical Simulations of Multiphase Flows*.(2012)
- Unverdi, S., Tryggvason, G., *A front-tracking method for viscous, incompressible multifluids flow*, *J. Comput. Phys.*, 100 (1992), pp. 25- 37.
- F.Tuakia, *Dasar-dasar CFD Menggunakan Fluent*. Informatika Bandung, Bandung,(2008)
- Wang, H.C, *Transfer of a Droplet Impinging Upon a Hot Surface*, *Journal Int Comm Heat Mass Transfer*, Vol 24/1.
- Wei Yao .,2017,A low-dissipation scheme based on OpenFoam designed for large eddy simulation in compressible flow, Conference Paper (PDF Available), Chinese Academy of Sciences
- Whisenant, S.G., et al., 1993, *Droplet Size and Spray Volume Effects on Honey Mesquite Mortality with Clopyralid*, *J. Range Manage*, 46, 257-261.
- White, F.M., 1991, *Heat and Mass Transfer*, University of Rhode Island
- Williamson, N.J., 2008, *Numerical Modelling of Heat and Mass Transfer and Optimisation of a Natural Draft Wet Cooling*, The University of Sydney
- Yarin, A.L., 2006, Drop Impact Dynamics: Splashing, Spreading, Receding, Bouncing, *Annual Review of Fluid Mechanics* 38, 159–192.



**Simulasi Numerik pada Fenomena Droplet yang Menumbuk Permukaan Padat Menggunakan Metode  
Beda Hingga  
dan Front Tracking**

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