Thermodynamics

Source: Britannica 'ENTROPY, A BROKEN PLATE Second law of thermodynamics'

Thermodynamics deals with equilibrium, energy and its transformation from one form to another. The behavior and interaction of thermodynamic quantities are defined by the four laws of thermodynamics. The applications of thermodynamics span a broad range of fields in science and engineering, especially physical chemistry and mechanical engineering. The use of the knowledge also has a close relationship with our everyday life, such as engines in vehicles and vapor power cycles in refrigerators.

This reading list contains over 70 publications, from classic titles tracing back to 1929 to most recent publications in 2016, and aims to provide rich resources from various topical perspectives.

The Library will periodically add new resources to this list. Links to the full-text are indicated. If you encounter any problem in retrieving the materials, please contact library@sutd.edu.sg for assistance.

Please also forward us titles that you would like to share with others in this list.

TOPICS

General Readings

Selection of elementary book titles that cover a broad range of topics in thermodynamics and are available in SUTD Library physical collection.

Cengel, Y. A., Boles, M. A., & Kanoğlu, M. (2015). *Thermodynamics: An engineering approach* (8th ed.). New York: McGraw-Hill.
Main Library Reference (TJ265 THE)

Fermi, Enrico. (1936). *Thermodynamics*. Dover Publications.
Main Library General Lending/ Reference (QC311 FER)

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The Laws of Thermodynamics

The most fundamental rules that define physical quantities (temperature, energy, and entropy) which characterize thermodynamic systems.

Atkins, P. W. (2007). *Four laws that drive the Universe*. Oxford: OUP Oxford.

Atkins, P. W. (2010). *The laws of thermodynamics: A very short introduction*. Oxford: Oxford University Press.

Čápek, V., & Sheehan, D. P. (2005). *Challenges to the second law of thermodynamics*. Springer Netherlands.

McGlashan, M. L. (1966). The use and misuse of the laws of thermodynamics. *Journal of Chemical Education*, *43*(5), 226.

Sandler, S. I., & Woodcock, L. V. (2010). Historical observations on laws of thermodynamics. *Journal of Chemical & Engineering Data*, *55*(10), 4485-4490.

Science. (1947). Laws of thermodynamics. *Science*, *106*(2758), 445.

Serrin, J. (1979). Conceptual analysis of the classical second laws of thermodynamics. *Archive for Rational Mechanics and Analysis*, *70*(4), 355–371.

The Lancet. (2000). Back to the laws of thermodynamics. *The Lancet*, *356*(9244), 1781.

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Energy

In thermodynamic processes, energy is exchanged between substances or systems, known as heat or work.

DeVoe, H. (2007). Particle model for work, heat, and the energy of a thermodynamic system. *Journal of Chemical Education*, *84*(3), 504.

Dincer, I. & Rosen, M. A. (2010). *Thermal energy storage: Systems and applications*. Hoboken, GB: Wiley.

Esen, H., Inalli, M., Esen, M., & Pihtili, K. (2007). Energy and exergy analysis of a ground-coupled heat pump system with two horizontal ground heat exchangers. *Building and Environment*, *42*(10), 3606-3615.

Finck, J. L. (1948). Thermodynamics, part II: Work, heat, and temperature concepts, and an examination of the temperature scale. *Journal of the Franklin Institute*, *245*(5), 365-378.

Kanoglu, M., Dincer, I., & Rosen, M. A. (2007). Understanding energy and exergy efficiencies for improved energy management in power plants. *Energy Policy*, *35*(7), 3967-3978.

Knuiman, J. T., Barneveld, P. A., & Besseling, N. A. M. (2012). On the relation between the fundamental equation of thermodynamics and the energy balance equation in the context of closed and open systems. *Journal of Chemical Education*, *89*(8), 968–972.

Langemeyer, M., & Holthaus, M. (2014). Energy flow in periodic thermodynamics. *Physical Review E*, *89*(1).

Rosakis, P., Rosakis, A.J., Ravichandran, G., & Hodowany, J. (2000). A thermodynamic internal variable model for the partition of plastic work into heat and stored energy in metals. *Journal of the Mechanics and Physics of Solids*, *48*(3), 581-607.

Sieniutycz, S., & Vos, A. D. (ed.). (2000). *Thermodynamics of energy conversion and transport*. Springer New York.

Struchtrup, H. (2014). *Thermodynamics and energy conversion*. Springer-Verlag Berlin Heidelberg.

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Enthalpy

A quantitative measurement of energy in a thermodynamic system.

Acree, W. E. (1991). Thermodynamic properties of organic compounds: Enthalpy of fusion and melting point temperature compilation. *Thermochimica Acta*, *189*(1), 37-56.

Dunitz, J. D. (1995). Win some, lose some: Enthalpy-entropy compensation in weak intermolecular interactions. *Chemistry & Biology*, 2(11), 709-712.

Goldstein, M. (1963). Some thermodynamic aspects of the glass transition: Free volume, entropy, and enthalpy Theories. *The Journal of Chemical Physics*, *39*, 3369-3374.

Lee, B. (1994). Enthalpy-entropy compensation in the thermodynamics of hydrophobicity. *Biophysical Chemistry*, *51*(2), 271-278.

Makhatadze, G. I., & Privalov, P. L. (1993). Contribution of hydration to protein folding thermodynamics: I. The enthalpy of hydration. *Journal of Molecular Biology*, *232*(2), 639-659.

Qian, H., & Hopfield, J. J. (1996). Entropy-enthalpy compensation: Perturbation and relaxation in thermodynamic systems. *The Journal of Chemical Physics*, *105*, 9292-9298.

Silvester, L.F., & Pitzer, K.S. (1976). Thermodynamics of electrolytes. X. Enthalpy and the effect of temperature on the activity coefficients. *Journal of Solution Chemistry*, *7*(5), 327–337.

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Entropy

A quantitative measurement of disorder or random activity in an isolated thermodynamic system.

Bejan, A. (1996). Entropy generation minimization: The new thermodynamics of finite-size devices and finite-time processes. *Journal of Applied Physics*, *79*, 1191-1218.

Bejan, A. (2002). Fundamentals of exergy analysis, entropy generation minimization, and the generation of flow architecture. *International Journal of Energy Research*, *26*(7), 0–43.

Ben-Naim, A. (2010). *Discover entropy and the second law of thermodynamics: A playful way of discovering a law of nature*. River Edge, SG: World Scientific.

Dixit, P. D. (2013). A maximum entropy thermodynamics of small systems. *The Journal of Chemical Physics*, *138*, 184111.

Shiner, J. S. (1996). *Entropy and entropy generation: Fundamentals and applications*. Hingham, US: Kluwer Academic Publishers.

Sinha, D. (2014). Entropy changes in a thermodynamic process under potential gradients. *Physica A: Statistical Mechanics and its Applications*, *416*, 676-683.

Thess, A. (2011). *The entropy principle*. Springer-Verlag Berlin Heidelberg.

Thoma, J., & Mocellin, G. (2006). *Simulation with entropy in engineering thermodynamics*. Springer-Verlag Berlin Heidelberg.

Wright, S. E., Scott, D. S., Haddow, J. B., & Rosen, M. A. (2001). On the entropy of radiative heat transfer in engineering thermodynamics. *International Journal of Engineering Science*, *39*(15), 1691-1706.

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Ideal Gas Model

Predicting the behavior of gases, the model is the most commonly used gas models in engineering thermodynamics.

Christen, W., Rademann, K., & Even, U. (2010). Supersonic beams at high particle densities: Model description beyond the ideal gas approximation. *The Journal of Physical Chemistry*, *114*(42), 11189-11201.

Gord, M. F., & Jannatabadi, M. (2014). Simulation of single acting natural gas Reciprocating Expansion Engine based on ideal gas model. *Journal of Natural Gas Science and Engineering*, *21*, 669-679.

Li, X., Christopher, D. M., & Bi, J. (2014). Release models for leaks from high-pressure hydrogen storage systems. *Chinese Science Bulletin*, *59*(19), 2302-2308.

Mironov, D., & Sossinsky, A. (2015). The modified ASEP as a model of ideal gas. *Russian Journal of Mathematical Physics*, *22*(1), 68-73.

Paolini, C. P., & Bhattacharjee, S. (2012). IGE model: An extension of the ideal gas model to include chemical composition as part of the equilibrium state. *Journal of Thermodynamics*, *2012*(2012).

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Properties of a Pure Substance

The relationship between pressure, specific volume, and temperature for a pure substance, which is defined as a material with homogeneous and invariable composition.

Abdollahi-Demneh, F., Moosavian, M. A., Montazer-Rahmati, M. M., Omidkhah, M. R., & Bahmaniar, H. (2010). Comparison of the prediction power of 23 generalized equations of state: Part I. Saturated thermodynamic properties of 102 pure substances. *Fluid Phase Equilibria*, *288*(1-2), 67-82.

Adebiyi, G. A. (2005). Formulations for the thermodynamic properties of pure substances. *Journal of Energy Resources Technology*, *127*(1), 83-87.

Curl, R. F., & Pitzer, K. (1958). Volumetric and thermodynamic properties of fluids - Enthalpy, free energy, and entropy. *Industrial & Engineering Chemistry*, *50*(2), 265-274.

Grigoras, S. (1990). A structural approach to calculate physical properties of pure organic substances: The critical temperature, critical volume and related properties. *Computational Chemistry*, *11*(4), 493–510.

Guria, C., & Pathak, A. K. (2012). An improved generalized three-parameter cubic equation of state for pure fluids. *Journal of Petroleum Science and Engineering*, *96–97*, 79-92.

Kessel'man, P. M., & Inshakov, S. A. (1984). Equation of state and thermodynamic properties of the condensed phase of a pure substance. *Journal of Engineering Physics*, *46*(6), 693–697.

Lowry, T. M. (1929). Pure substances: Their preparation, properties, and uses. *Nature*, *123*(3096), 308-310.

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Reversible and Irreversible Processes

Two main types of thermodynamic processes. Reversible process is an ideal process, while all the processes occurring in the Universe are irreversible.

Al-Ghoul, M., & Eu, B. C. (1996). Hyperbolic reaction-diffusion equations and irreversible thermodynamics: Cubic reversible reaction model. *Physica D: Nonlinear Phenomena*, *90*(1), 119-153.

Anacleto, J., & Ferreira, J. M. (2015). Reversible versus irreversible thermalization of two finite blocks. *European Journal of Physics*, *37*(2).

Gislason, E. A., & Craig, N. C. (2002). First law of thermodynamics: Irreversible and reversible processes. *Journal of Chemical Education*, *79*(2), 193.

Gonzalez-Ayala, J., Angulo-Brown, F., Hernández, A. C., & Velasco, S. (2016). On reversible, endoreversible, and irreversible heat device cycles versus the Carnot cycle: A pedagogical approach to account for losses. *European Journal of Physics*, *37*(4).

Gorban, A. N., Mirkes, E. M., & Yablonsky, G. S. (2013). Thermodynamics in the limit of irreversible reactions. *Physica A: Statistical Mechanics and its Applications*, *392*(6), 1318-1335.

Okuma, S., Suzuki, Y., & Tsugawa, Y. (2010). Reversible to irreversible flow transition in driven vortices. *Physica C: Superconductivity*, *470*(Supplement 1), S842-S843.

Río, F., & Selva, S. M. T. (2015). Reversible and irreversible heat transfer by radiation. *European Journal of Physics*, *36*(3).

Tsirlin, A. M., Kazakov, V., & Zubov, D. V. (2002). Finite-time thermodynamics: Limiting possibilities of irreversible separation processes. *The Journal of Physical Chemistry A*, *106*(45), 10926–10936.

Wang, X. (2010). Irreversible cycle in linear irreversible thermodynamics. *Journal of Physics A: Mathematical and Theoretical*, *43*(42).

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Thermodynamic Equilibrium State

A state of balance, with no heat transfer either within a system or between different systems.

Calzada, M. D., García, M. C., Luque, J. M., & Santiago, I. (2002). Influence of the thermodynamic equilibrium state in the excitation of samples by a plasma at atmospheric pressure. *Journal of Applied Physics*, 92, 2269-2275.

Daïan, J. F. (2014). *Equilibrium and transfer in porous media 1: Equilibrium states*. Somerset, US: Wiley-ISTE.

Kondaurova, L. P., & Nemirovskii, S. K. (2009). Numerical simulation of stochastic motion of vortex loops under action of random force: Evidence of the thermodynamic equilibrium state. *Journal of Engineering Thermophysics*, *18*(1), 65-68.

Loskutov, Y. M. (2011). On the inequality of partial temperatures of a homogeneous gas mixture in the thermodynamic equilibrium state. *Journal of Mathematical Sciences*, *172*(6), 802-810.

Prausnitz, J. M., Lichtenthaler, R. N., & Azevedo, E. G. (1998). *Molecular thermodynamics of fluid-phase equilibria*. Prentice Hall.

Tretyakov, M. Y., Serov, E. A., & Odintsova, T. A. (2012). Equilibrium thermodynamic state of water vapor and the collisional interaction of molecules. *Radiophysics and Quantum Electronics, 54*(10), 700-716.

Turulski, J. (2015). Dimension of the Gibbs function topological manifold: 1. Graph representation of the thermodynamic equilibrium state. *Journal of Mathematical Chemistry, 53*(2), 495-513.

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Thermodynamic Systems

The definite macroscopic regions or space that exists, in which thermodynamic processes take place.

Chen, H., Goswami, D. Y., & Stefanakos, E. K. (2010). A review of thermodynamic cycles and working fluids for the conversion of low-grade heat. *Renewable and Sustainable Energy Reviews, 14*(9), 3059-3067.

Cheng, X., & Liang, X. (2015). Entransy analyses of heat–work conversion systems with inner irreversible thermodynamic cycles. *Chinese Physics B, 24*(12).

Drescher, U., & Brüggemann, D. (2007). Fluid selection for the Organic Rankine Cycle (ORC) in biomass power and heat plants. *Applied Thermal Engineering, 27*(1), 223-228.

Haddad, W. M., Chellaboina, V., & Nersesov, S. G. (2009). *Thermodynamics: A dynamical systems approach*. Princeton, US: Princeton University Press.

Morandin, M., Toffolo, A., & Lazzaretto, A. (2013). Superimposition of elementary thermodynamic cycles and separation of the heat transfer section in energy systems analysis. *Journal of Energy Resources Technology, 135*(2).

Nguyen, T., & Elmegaard, B. (2016). Assessment of thermodynamic models for the design, analysis and optimisation of gas liquefaction systems. *Applied Energy, 183*, 43-60.

Ozgener, O., & Hepbasli, A. (2005). Experimental performance analysis of a solar assisted ground-source heat pump greenhouse heating system. *Energy and Buildings, 37*(1), 101-110.

Wu, C. (2008). *Thermodynamics and heat powered cycles*. Hauppauge, US: Nova Science Publishers.

Yu, S., Chen, L., Zhao, Y., Li, H., & Zhang, X. (2015). A brief review study of various thermodynamic cycles for high temperature power generation systems. *Energy Conversion and Management, 94*, 68-83.

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