UNIT VD

THRUST ENGINES

This unit extends the analysis of gas power systems (Unit VA) to jet and rocket engines. The output of a thrust engine is measured by the increase in the kinetic energy, relative to the engine, that it produces. This total production provides a convenient basis for the determination of the thermal efficiency and efficiency ratio of jet and rocket engines. In addition to the thermal irreversibility that occurs within the cycle, propulsive systems suffer a mechanical loss equal to the absolute kinetic energy, relative to the ground, of the gases leaving the engine. This loss is defined in terms of the propulsive efficiency of the engine. This unit develops these thrust engine performance parameters and applies them to a number of jet and rocket systems.

Objectives

1. Determine the thermal, propulsive, and overall efficiency as well as the efficiency ratio of a turbojet, turbojet with an afterburner, and ramjet engine operating under specified conditions.
2. Determine the thrust per unit exit area for jet and rocket engine systems.
3. Determine the propulsive efficiency of a rocket system for given conditions.
4. Determine the effect of irreversibility of the diffuser, compressor, turbine, and/or nozzle on cycle performance as described by their isentropic efficiency.

Supplementary References

1. Faires, V. M., Thermodynamics, Fifth Ed., Macmillan (1970). Sects. 15.11 to 15.17. Comprehensive, similar to this unit. Could be used as a substitute for text. No example problems. Exers. 15.7 to 15.19.
2. Holman, J. P., Thermodynamics, Second Ed., McGraw-Hill (1974). Sects. 12-10 to 12-12, with Exmp. 12-12 and Exers. 12-28 and 12-29. Brief but comprehensive.
3. Reynolds, W. C., and Perkins, H. C., Engineering Thermodynamics, McGraw-Hill (1970). Sects. 9.16 to 9.17, with an example and Exers. 9.55 to 9.60. Brief treatment. Discusses systems not presented in this unit.

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