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(57) Abstract :
The present invention relates to a thermodynamic modeling method using differential equation mathematics for accurately representing the dynamic behavior of thermodynamic systems. The method formulates energy balance, mass balance, and entropy generation equations in differential form and couples them using appropriate equations of state. The coupled differential equations are solved using numerical techniques such as Runge–Kutta, finite difference, finite volume, or finite element methods to predict time-dependent variations of temperature, pressure, volume, mass flow, and entropy. The method can incorporate real-time sensor data to refine boundary conditions and improve predictive accuracy. The invention is applicable to a wide range of systems including heat exchangers, turbines, refrigeration units, boilers, engines, chemical reactors, and renewable-energy devices, enabling enhanced system design, performance optimization, and fault detection.
(Accompanied Figure No. 1)

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