Undergraduate Certificate in Advanced Combustion Engineering

Industrial Combustion System Optimization

A/F Ratio: The air to fuel ratio is a critical concept in Industrial Combustion System Optimization, referring to the proportion of air to fuel in a combustion reaction, with the ideal ratio varying depending on the fuel type and combustion process. Related terms include Stoichiometric Ratio and Excess Air.
Absolute Pressure: Absolute pressure is the total pressure exerted by a fluid, including the atmospheric pressure, and is an important consideration in combustion system design and operation.
Adiabatic Flame Temperature: The adiabatic flame temperature is the theoretical temperature that can be achieved in a combustion reaction, assuming no heat loss to the surroundings, and is a key concept in understanding combustion chemistry.
AFR: The air fuel ratio is a fundamental concept in combustion engineering, referring to the proportion of air to fuel in a combustion reaction, with the ideal ratio varying depending on the fuel type and combustion process.
Air Pollution: Air pollution is a significant environmental concern, resulting from the release of combustion byproducts, such as particulate matter, carbon monoxide, and nitrogen oxides, into the atmosphere.
Algorithm: An algorithm is a step-by-step procedure used to solve a complex problem, such as optimizing combustion system performance, by breaking it down into a series of smaller, more manageable tasks.
Alternative Fuel: An alternative fuel is a non-traditional fuel source, such as biodiesel or hydrogen, that can be used to reduce dependence on fossil fuels and mitigate environmental impacts.
Ambient Temperature: The ambient temperature is the surrounding temperature, or the temperature of the environment, which can affect combustion system performance and is an important consideration in system design.
Anaerobic Digestion: Anaerobic digestion is a biological process in which microorganisms break down organic matter in the absence of oxygen, producing a biogas that can be used as a fuel source.
Atomization: Atomization is the process of breaking a liquid fuel into small droplets, which increases the surface area and enhances combustion efficiency.
Automatic Control: Automatic control refers to the use of control systems to regulate combustion system performance, such as maintaining a consistent temperature or pressure, without the need for manual intervention.
Baffle: A baffle is a barrier or obstruction used to direct or modify the flow of fluids, such as air or fuel, in a combustion system.
Bernoulli's Principle: Bernoulli's principle is a fundamental concept in fluid dynamics, stating that the pressure of a fluid decreases as its velocity increases, which is relevant to combustion system design.
Blower: A blower is a device used to move air or other gases, such as in a combustion system, and can be powered by an electric motor or other energy source.
Boiler: A boiler is a closed vessel in which water is heated, producing steam, which can be used for power generation or other applications.
BTU: The British thermal unit is a unit of energy, used to express the heat content of a fuel or the energy output of a combustion system.

Burner: A burner is a device used to mix and ignite fuel and air, producing a flame, and is a critical component of a combustion system.
Calorific Value: The calorific value is a measure of the energy content of a fuel, expressed in terms of the amount of heat released per unit of fuel consumed.
Carbon Monoxide: Carbon monoxide is a toxic gas produced by incomplete combustion, which can have serious health and environmental impacts.
Catalyst: A catalyst is a substance that enhances the rate of a chemical reaction, such as the combustion of fuel, without being consumed in the process.
Cetane Number: The cetane number is a measure of the ignition quality of a diesel fuel, with higher numbers indicating better combustion performance.
Chemical Kinetics: Chemical kinetics is the study of the rates and mechanisms of chemical reactions, including combustion reactions, which is essential for understanding combustion chemistry.
Coal: Coal is a fossil fuel that can be used in combustion systems, either directly or in the form of coal gas or coal oil.
Combustion Chamber: The combustion chamber is the region in which fuel and air are mixed and ignited, producing a flame, and is a critical component of a combustion system.
Combustion Efficiency: Combustion efficiency is a measure of the effectiveness of a combustion system, expressed in terms of the amount of heat released per unit of fuel consumed.
Combustion Temperature: The combustion temperature is the temperature at which a fuel burns, which can affect the rate and efficiency of the combustion reaction.
Control Valve: A control valve is a device used to regulate the flow of fluids, such as air or fuel, in a combustion system.
Convection: Convection is the transfer of heat through the movement of fluids, which can occur in combustion systems and affect their performance.
Crude Oil: Crude oil is a fossil fuel that can be refined into various petroleum products, including gasoline, diesel fuel, and fuel oil.
Cycle: A cycle is a series of events or processes that are repeated in a regular sequence, such as the combustion cycle in an internal combustion engine.
Deflagration: Deflagration is a type of combustion wave that propagates through a fuel-air mixture at subsonic speeds, which can occur in combustion systems.
Density: Density is a measure of the mass of a substance per unit volume, which can affect the performance of a combustion system.
Diffusion: Diffusion is the process by which particles or molecules move from an area of higher concentration to an area of lower concentration, which can occur in combustion systems.
Dilution: Dilution is the process of reducing the concentration of a substance, such as a pollutant, by adding a diluent, such as air or water.
Displacement: Displacement is the process of moving a fluid, such as air or fuel, from one location to another, which can occur in combustion systems.
Dissociation: Dissociation is the process by which a molecule breaks into smaller molecules or atoms, which can occur in combustion reactions.
Drop Tube Furnace: A drop tube furnace is a type of combustion system in which fuel and air are mixed and ignited, producing a flame, and is used to study combustion chemistry.

Dust: Dust is a type of particulate matter that can be produced by combustion systems, which can have serious health and environmental impacts.
Eddy: An eddy is a swirling motion of a fluid, such as air or fuel, which can occur in combustion systems and affect their performance.
Efficiency: Efficiency is a measure of the effectiveness of a combustion system, expressed in terms of the amount of heat released per unit of fuel consumed.
Elasticity: Elasticity is the ability of a substance to return to its original shape after being deformed, which can affect the performance of a combustion system.
Electrostatic Precipitator: An electrostatic precipitator is a device used to remove particulate matter from a gas stream, such as in a combustion system.
Emission: An emission is the release of a substance, such as a pollutant, into the environment, which can have serious health and environmental impacts.
Energy Balance: An energy balance is a calculation of the energy inputs and outputs of a combustion system, which can be used to optimize its performance.
Energy Density: Energy density is a measure of the energy content of a fuel per unit of volume or mass, which can affect the performance of a combustion system.
Enthalpy: Enthalpy is a measure of the total energy of a system, including the internal energy and the energy associated with the pressure and volume of a system.
Entropy: Entropy is a measure of the disorder or randomness of a system, which can increase or decrease during a combustion reaction.
Equivalence Ratio: The equivalence ratio is a measure of the ratio of the actual fuel-air mixture to the stoichiometric fuel-air mixture, which can affect the performance of a combustion system.
Excess Air: Excess air is the amount of air that is present in a combustion reaction in excess of the stoichiometric amount, which can affect the performance of a combustion system.
Exergy: Exergy is a measure of the maximum amount of work that can be extracted from a system, which can be used to optimize the performance of a combustion system.
Fahrenheit: Fahrenheit is a temperature scale that is commonly used in combustion systems, with the freezing point of water defined as 32 degrees and the boiling point defined as 212 degrees.
Fan: A fan is a device used to move air or other gases, such as in a combustion system, and can be powered by an electric motor or other energy source.
Firing Rate: The firing rate is the amount of fuel that is burned per unit of time, which can affect the performance of a combustion system.
Flame: A flame is a region of high temperature and chemical reactivity, produced by the combustion of fuel, which can be characterized by its color, shape, and size.
Flame Speed: The flame speed is the rate at which a flame propagates through a fuel-air mixture, which can affect the performance of a combustion system.
Flare: A flare is a device used to burn waste gases, such as in a combustion system, and can be used to reduce emissions and improve safety.
Flow Meter: A flow meter is a device used to measure the flow rate of a fluid, such as air or fuel, which can be used to optimize the performance of a combustion system.
Fluid Dynamics: Fluid dynamics is the study of the behavior of fluids, such as air or fuel, which can be used to understand and optimize the performance of combustion systems.

Fuel: A fuel is a substance that can be burned to produce energy, such as gasoline, diesel fuel, or natural gas, which can be used in combustion systems.
Fuel-Air Ratio: The fuel-air ratio is the proportion of fuel to air in a combustion reaction, which can affect the performance of a combustion system.
Gas: A gas is a state of matter that is characterized by a lack of definite shape and volume, such as air or fuel, which can be used in combustion systems.
Heat Exchanger: A heat exchanger is a device used to transfer heat from one fluid to another, such as in a combustion system, which can be used to optimize its performance.
Heat Transfer: Heat transfer is the process by which heat is transferred from one location to another, such as in a combustion system, which can occur through conduction, convection, or radiation.
Humidity: Humidity is the amount of water vapor present in the air, which can affect the performance of a combustion system.
Hydrocarbon: A hydrocarbon is a type of fuel that is composed of hydrogen and carbon atoms, such as gasoline or diesel fuel, which can be used in combustion systems.
Ignition: Ignition is the process by which a fuel is ignited, producing a flame, which can occur through various means, such as a spark or heat.
Impeller: An impeller is a device used to move a fluid, such as air or fuel, which can be used in a combustion system.
Inert Gas: An inert gas is a type of gas that does not react with other substances, such as nitrogen or argon, which can be used in combustion systems to reduce emissions.
Infrared: Infrared is a type of electromagnetic radiation that can be used to measure the temperature of a combustion system.
Injection: Injection is the process of introducing a fuel into a combustion system, which can occur through various means, such as a fuel injector.
Insulation: Insulation is a material used to reduce heat transfer, such as in a combustion system, which can be used to optimize its performance.
Intercooler: An intercooler is a device used to cool a fluid, such as air or fuel, which can be used in a combustion system to optimize its performance.
Ionization: Ionization is the process by which a molecule or atom gains or loses electrons, producing ions, which can occur in combustion reactions.
Isothermal: Isothermal is a process that occurs at a constant temperature, which can be used to optimize the performance of a combustion system.
Kinetic Energy: Kinetic energy is the energy associated with the motion of an object, such as a fluid or a particle, which can affect the performance of a combustion system.
Laminar Flow: Laminar flow is a type of fluid flow that is characterized by smooth, continuous motion, which can occur in combustion systems.
Lewis Number: The Lewis number is a dimensionless quantity that is used to characterize the ratio of thermal diffusivity to mass diffusivity, which can affect the performance of a combustion system.
LHV: The lower heating value is a measure of the energy content of a fuel, expressed in terms of the amount of heat released per unit of fuel consumed.
Mass Flow Rate: The mass flow rate is the amount of mass that flows through a system per unit of time, which can affect the performance of a combustion system.

Mass Transfer: Mass transfer is the process by which mass is transferred from one location to another, such as in a combustion system, which can occur through various means, such as diffusion or convection.
Mean Free Path: The mean free path is the average distance that a molecule travels before colliding with another molecule, which can affect the performance of a combustion system.
Mixing: Mixing is the process of combining two or more substances, such as air and fuel, which can occur in combustion systems.
Mole Fraction: The mole fraction is a measure of the proportion of a substance in a mixture, expressed in terms of the number of moles of the substance per total number of moles in the mixture.
Molecular Weight: The molecular weight is the sum of the atomic weights of the atoms in a molecule, which can affect the performance of a combustion system.
Natural Gas: Natural gas is a type of fuel that is composed of methane and other hydrocarbons, which can be used in combustion systems.
Nitrogen Oxides: Nitrogen oxides are a type of pollutant that can be produced by combustion systems, which can have serious health and environmental impacts.
Nozzle: A nozzle is a device used to accelerate a fluid, such as air or fuel, which can be used in a combustion system.
Octane Number: The octane number is a measure of the ignition quality of a gasoline fuel, with higher numbers indicating better combustion performance.
Oxygen: Oxygen is a reactant that is necessary for combustion to occur, which can be used in combustion systems.
Particulate Matter: Particulate matter is a type of pollutant that can be produced by combustion systems, which can have serious health and environmental impacts.
Pascal: The pascal is a unit of pressure that is commonly used in combustion systems.
Pilot Flame: A pilot flame is a small flame that is used to ignite a larger flame, which can be used in combustion systems.
Pipeline: A pipeline is a system of pipes used to transport a fluid, such as natural gas or fuel oil, which can be used in combustion systems.
Power: Power is the rate at which energy is transferred or converted, which can be used to optimize the performance of a combustion system.
Pressure: Pressure is the force exerted per unit area on an object or surface, which can affect the performance of a combustion system.
Pressure Drop: The pressure drop is the difference in pressure between two points in a system, which can affect the performance of a combustion system.
Radiation: Radiation is a mode of heat transfer that occurs through electromagnetic waves, which can occur in combustion systems.
Reactor: A reactor is a device used to contain and control a chemical reaction, such as a combustion reaction, which can be used to optimize the performance of a combustion system.
Recirculation: Recirculation is the process of reusing a fluid, such as air or fuel, which can occur in combustion systems.
Recuperator: A recuperator is a device used to transfer heat from one fluid to another, such as in a combustion system, which can be used to optimize its performance.
Regenerator: A regenerator is a device used to transfer heat from one fluid to another, such as in a

combustion system, which can be used to optimize its performance.
Reynolds Number: The Reynolds number is a dimensionless quantity that is used to characterize the nature of fluid flow, which can affect the performance of a combustion system.
Safety Valve: A safety valve is a device used to prevent overpressure in a system, such as a combustion system, which can be used to optimize its performance and ensure safety.
Scrubber: A scrubber is a device used to remove pollutants from a gas stream, such as in a combustion system, which can be used to optimize its performance and reduce emissions.
Sensor: A sensor is a device used to measure a physical parameter, such as temperature or pressure, which can be used to optimize the performance of a combustion system.
Soot: Soot is a type of pollutant that can be produced by combustion systems, which can have serious health and environmental impacts.
Specific Heat: The specific heat is the amount of heat energy required to raise the temperature of a substance by one degree, which can affect the performance of a combustion system.
Steam: Steam is a state of water that is characterized by a high temperature and pressure, which can be used in combustion systems.
Stoichiometric: Stoichiometric refers to the ideal proportion of reactants in a chemical reaction, such as a combustion reaction, which can be used to optimize the performance of a combustion system.
Sulfur Dioxide: Sulfur dioxide is a type of pollutant that can be produced by combustion systems, which can have serious health and environmental impacts.
Supercritical: Supercritical refers to a state of matter that is characterized by a temperature and pressure above the critical point, which can occur in combustion systems.
Temperature: Temperature is a measure of the average kinetic energy of the particles in a substance, which can affect the performance of a combustion system.
Thermal Conductivity: The thermal conductivity is a measure of the ability of a substance to conduct heat, which can affect the performance of a combustion system.
Thermal Diffusivity: The thermal diffusivity is a measure of the ability of a substance to transfer heat, which can affect the performance of a combustion system.
Thermocouple: A thermocouple is a device used to measure temperature, which can be used to optimize the performance of a combustion system.
Turbulence: Turbulence is a type of fluid flow that is characterized by chaotic, irregular motion, which can occur in combustion systems.
Turbulent Flow: Turbulent flow is a type of fluid flow that is characterized by chaotic, irregular motion, which can occur in combustion systems.
UHC: The unburned hydrocarbon is a type of pollutant that can be produced by combustion systems, which can have serious health and environmental impacts.
Ullage: The ullage is the space between the top of a liquid and the top of a container, which can be used to optimize the performance of a combustion system.
Valve: A valve is a device used to control the flow of a fluid, such as air or fuel, which can be used to optimize the performance of a combustion system.
Velocity: Velocity is the rate of change of position of an object, such as a fluid or a particle, which can affect the performance of a combustion system.
Viscosity: Viscosity is the measure of the resistance of a fluid to flow, which can affect the performance of a

combustion system.
Vortex: A vortex is a type of fluid flow that is characterized by a rotating, swirling motion, which can occur in combustion systems.
Waste Heat: Waste heat is the energy that is lost or wasted in a system, such as a combustion system, which can be used to optimize its performance.
Water Gas: Water gas is a type of fuel that is produced by the reaction of water with a hydrocarbon fuel, which can be used in combustion systems.
Wavelength: The wavelength is the distance between two successive points of the same phase on a wave, which can be used to measure the temperature of a combustion system.