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Chapter 1 : Control systems - Course

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Chapter 2 : Engineering Notes Handwritten class Notes Old Year Exam Question

Lecture Notes on Control Systems/D. Ghose/ 3 Control Problem Let us be a little more speciï¬•c about what constitutes a control problem and what are.

Keeping this in view, we will discuss the various options of energy generation from waste. Incineration and Energy Recovery 8. In the past, it was common to simply burn MSW in incinerators to reduce its volume and weight, but energy recovery has become more prevalent EPA and In waste-to-energy WTE plants, heat from the burning waste is absorbed by water in the wall of the furnace chamber, or in separate boilers. Water when heated to the boiling point changes to steam. At this point, the steam is used either for heating or to turn turbines to generate electricity. The amount of energy recovered from waste is a function of the amount of waste combusted, energy value of the waste stream and the efficiency of the combustion process UNEP The three basic types of waste-to-energy incineration are: Electricity is the most common form of energy produced and sold from WTE facilities constructed today. By directing the steam produced from a WTE system through a turbine generator, electricity can be produced and sold. A process flow diagram of an electrical generation system is shown in Figure 8. Of the electricity produced in incineration facilities, about one-fifth is used at the facility for general operations, and the remainder is sold to public and private utilities or nearby industries. In many countries, utilities provide a stable market for electricity generated from incinerators. The availability of purchasers and rates for electricity sales will, however, vary by region. Steam is used widely in a variety of industrial applications. Steam generated in incineration facilities can also be used directly by a customer for manufacturing operations. Steam generated in an incinerator is supplied to a customer through a steam line, and a separate line sometimes returns the condensed steam. It can be used to drive machinery such as compressors, for space heating and generating electricity. Industrial plants, dairies, cheese plants, public utilities, paper mills, tanneries, breweries, public buildings and many other businesses use steam for heating and air conditioning. Proximity is important because steam cannot usually be economically transported more than one or two miles. The WTE facility, therefore, should be as close as possible to the potential market. The advantages of transmitting steam over a long distance to an end user must be weighed against energy losses that will occur in transmission. Installation of a pipeline connecting the facility and the customer can also be prohibitively expensive in certain circumstances. High-temperature hot water may be an option for overcoming the transmission limitation for steam. Anticipated steam quantity and quality are interrelated parameters, and must be carefully projected when assessing steam markets. The prospective user will most likely have an existing process requiring steam at a specific temperature and pressure. The quantity of steam produced from a given amount of waste will decrease, as the steam temperature and pressure increase, but the equipment using the steam will operate more efficiently. To ensure the continuing availability of high quantity and quality steam, supplementary fuels, such as natural gas, may occasionally be used, but this will result in an increase in the operating costs. Co-generation refers to combined production of steam and electricity and can occur in two ways. If the steam purchaser cannot accept all the steam produced by the facility, the excess can be converted to electricity. In cogeneration, high-pressure steam is used first to generate electricity; the steam leaving the turbine is then used to serve the steam users. Co-generation allows flexibility, so that seasonal variations in steam demand can be offset by increases in electricity production, and can provide the project a financial base by selling electricity, should the steam customer become unavailable. The major risks of incinerators are the potential emission of contaminants into the air through exhaust stack or into the water through ash leachate. Proper planning to minimise these problems as well as public education and involvement that directly address these issues are essential for a successful incineration programme. The majority of modern incinerators, however, produce less particulate and gaseous pollutants than their predecessors. Also, emissions from incinerators are controlled by a combination of measures that use both the pollution prevention approach and various control equipment. We will describe the main gaseous pollutants and their control measures, respectively, in Subsections 8. This is one of the main products of incineration, and the other main product is water. At low concentrations, CO 2 has no short-term toxic or irritating effect, as it is abundant in the atmosphere and necessary for plant life and is not generally considered a pollutant. Nevertheless, due to the high increase in global concentration of CO 2, it has been recognised as one of the gases responsible for global warming. An incomplete combustion of carbon due to the lack of oxygen forms CO. This gas is toxic, as it reacts with the haemoglobin in the blood, causing a decrease of available oxygen to the organisms. This lack of oxygen produces headache, nausea, suffocation and eventually death. Carbon monoxide in the flue gas is used to monitor the incomplete combustion of the other emissions, such as un-burnt hydrocarbons and provide information on the performance of the incinerator. Sulphur oxides SO x: The emission of SO x is a direct result of the oxidation of sulphur present in solid waste, but other conditions such as the type of Unit 8: Incineration and Energy Recovery incinerator used and its operating conditions also influence its production. At high concentrations, it causes eye, nose and throat irritation, and other respiratory problems. Nitrogen oxides NO x: This is predominantly formed during the incineration process. However, they oxidise to NO 2 in the atmosphere. In thermal formation, the oxygen and nitrogen react in the air. Fuel NO x is formed during the reactions between oxygen and nitrogen in the fuel. Nitrogen oxides are important, as they participate in several processes in atmospheric chemistry. They are precursors of the formation of ozone O 3 and preoxy acetal nitrate PAN. These photochemical oxidants are responsible for smog formation and cause acid rain. This is formed during the combustion process by several mechanisms. The turbulence in the combustion chambers may carry some ash into the exhaust flow. Other inorganic materials present in the waste volatilise at combustion temperature and later condense downstream to form particles or deposits on ash particles. The main component of fly ash is chemically inert silica; but it may also contain toxic metal and organic substances. Hydrochloric acid results from the high concentration of chlorine containing materials e. Chlorine easily dissolves in water to form HCl. Its presence in the gaseous state may increase the acidity of local rain and ground water, which can damage exposed and unprotected metal surfaces, erode buildings and may affect the mobilisation of heavy metals in soil. Hydrogen fluoride is more toxic and corrosive than HCl, although its presence in the emissions from solid waste incinerators occurs in much smaller quantities. It is formed due to the presence of trace amounts of fluorine in the waste. Solid waste contains heavy metals and metallic compounds in the combustible and incombustible fractions. During the incineration process, metals may vaporise directly or form oxides or chlorides at high temperatures in the combustion zone. They condensate over other particles and leave the incineration process in the flue gas. Dioxins can be formed in all combustion processes, where organic carbon, oxygen and chlorine are present, although the processes by which they are formed during incineration are not completely understood. The concern over dioxins and furans has increased after a number of animal studies have shown that for some species, they are carcinogenic and highly toxic, even at very low levels of exposure. These are used for particle control. ESP use electric forces to move the particle flowing out of the gas stream on to the collector electrodes. The particles get a negative charge, when they pass through an ionised field. The electric field that forces the charged particles to the walls comes from discharged electrodes maintained at high voltage in the centre of the flow lane. When particles are collected, they must be carefully removed to avoid their entry into the gaseous stream. This is achieved by knocking them loose from the plates and by intermittent and continuous washing with water. Particle size and other physical characteristics such as gas stream temperature, flue gas volume, moisture content, gas stream composition, particle composition and particle surface characteristics affect the performance of the equipment. Incineration and Energy Recovery configurations: These configurations can be wet or dry, depending on the method of dust collection. In fabric filtration, the gas flows through a number of filter bags placed in parallel, leaving the dust captured by the fabric. Extended operation of fabric filters requires periodic cleaning of the cloth surface. After a new fabric goes through a number of cycles of use and cleaning, it forms a residual cake of dust that becomes the filter medium, which is responsible for highly efficient filtering of small particles that characterises fabric filter. They are widely accepted for controlling particulate matter. The type of cloth fabric limits the temperature of operation of fabric cloth: This temperature requirement makes the use of a cooling system necessary for the gas, before it enters the equipment, but it is also necessary that the temperature of the exhaust gas stream be maintained above the dew point because liquid particles block the pores in the fabric very quickly. The major difference between different configurations of fabric filters is the cleaning method used during operating cycles such as shaker, reverse-air and pulse-jet cleaning. Scrubbers are used to control particulate matter and acid gases leaving the incinerator. Particulates and gases are removed from the gas stream mainly by absorption and adsorption. The particles are moved to the vicinity of the water droplets and collide with each other. The particles adhere to the liquid media and precipitate to the bottom of the unit containing the dust particle from the gas phase. In addition to removing entrapped particulate matter, scrubbers can also remove gases by absorption and adsorption. Any other type of particulate control equipment does not possess this capability of scrubber. It can remove particles of size 0. The various types of scrubbers can be dry, semi-dry or wet, depending on the composition of flue gas. Apart from air pollution, there are other environmental concerns related to incineration EPA and , some of which are touched upon below: Wastewater in an incineration facility can be generated in various forms. These include tipping floor runoff system wash water, ash quench water and water from pollution control systems. These systems also deal with normal problems experienced by all large industrial facilities, including sanitary wastewater disposal and surface-water runoff. For most incineration facilities, wastewater can be recycled in a closed-loop system.

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Chapter 3 : IIT khargpur Control Systems Lecture Notes pdfâ€Ž

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The course exposes students to control design for continuous-time linear time-invariant LTI systems. The course focuses primarily on using Laplace and frequency-domain techniques. It discusses design of 1-degree of freedom i. It also discusses the fundamental limits associated with control design and the related trade-offs that need to be made during design. Jayanth obtained his B. His research interests include precision motion measurement and control, nanometrology and manipulation, scanning probe microscopy, micro-robotics and optical sensors. Linear system theory, Fourier and Laplace transforms, Transfer functions Week 2: Fundamentals of feedback control, Nyquist stability theory Week 3: Bode plots, Design of 1-degree of freedom control systems part 1 Week 4: Design of 1-degree of freedom control systems part 2 Week 5: Robust control 2 parts Week 6: Quantitative Feedback Theory Parts 1 and 2 Week 7: Control of non-minimum phase systems 2 parts Week Control of unstable systems 2 parts Week Describing functions, Solved examples Week Lecture notes The exam is optional for a fee. Date and Time of Exam: October 28, Sunday: Morning session 9am to 12 noon; Afternoon session: Announcements will be made when the registration form is open for registrations. The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. Final score will be calculated as: Certificate will have your name, photograph and the score in the final exam with the breakup.

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Chapter 7 : Power System Â« Sohail Ansari

Course Objective: To provide a basic understanding of the concepts and techniques involved in designing control schemes for dynamic systems. Learning Outcomes: At the end of this course, one should possess in-depth knowledge of concepts from classical control theory, understand the concept of transfer function and use it for obtaining system response, analyze dynamic systems for their.

Chapter 8 : Syllabus | Feedback Control Systems | Aeronautics and Astronautics | MIT OpenCourseWare

The course exposes students to control design for continuous-time linear time-invariant (LTI) systems. The course focuses primarily on using Laplace and frequency-domain techniques.

Chapter 9 : NPTEL Handwritten Notes Â« Sohail Ansari

Lecture series on Control Engineering by Prof. Madan Gopal, Department of Electrical Engineering, IIT Delhi. For more details on NPTEL visit racedaydvl.com