ΕΘΝΙΚΟ ΜΕΤΣΟΒΙΟ ΠΟΛΥΤΕΧΝΕΙΟ
ΣΧΟΛΗ ΧΗΜΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

ΕΠΙΤΡΟΠΗ ΣΕΜΙΝΑΡΙΩΝ, Καθηγητής Α. Κοκόσης

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ΣΕΜΙΝΑΡΙΟ ΧΗΜΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

Πέμπτη 18 Φεβρουαρίου, 13:00

Αίθουσα Σεμιναρίων «Ν. Κουμούτσου»

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MODEL-BASED ANALYSIS OF THE ENERGY SAVING POTENTIAL IN CHEMICAL BATCH PLANTS

Presently, energy saving motivation of the chemical manufacturers is growing due to high prices of primary energy sources and environmental concerns. Therefore, efficient and reliable methodologies and tools allowing analysis and optimization of the energy demand are of high importance for the industry. A critical point regarding energy saving identification and analysis of chemical processes is to define their efficiency from energy consumption standpoint. A few energy efficiency definitions based on thermodynamic, physical-thermodynamic, economic-thermodynamic and economic indicators appeared in the past. However, not much attention has been paid to the challenging environment of the multipurpose batch plants, and especially to the identification of the energy savings that can be achieved with proper monitoring of the plant operation not involving severe retrofitting actions and capital cost investment. In the present study we propose and analyze the use of Energy Key Performance Indicators (EKPIs) specially tailored for monitoring batch heating processes. The EKPIs are calculated on the basis of an underlying model that describes the efficiency of the heating processes in various combinations of unit operations, equipments and heating/cooling (H/C) systems. These EKPIs capture batch-to batch variability in energy consumption for a given monitoring period due to control strategies, controller malfunctions and scheduling decisions, facilitating in this way efficiency screening on the plant level that can be followed by a detailed analysis of the unit operations (UOs) on the equipment level. To exemplify this approach the energy saving potential analysis for a multipurpose industrial plant comprising 46 UOs and 38 production lines is presented. It is shown that significant energy consumption was identified within synchronization steps representing a non-productive part of the batch production. It was identified that the high energy loss in the synchronization steps was caused by overheating/overcooling problems of the temperature control loop together with a long duration of the synchronization steps in the low-performing batches. In this case it has been proposed that observed energy losses can be easily reduced by appropriate maintenance of particular UOs.