Model-based off-line optimization with modified Lyapunov function for pre-cooling process of CO2 storage tank in CCS ship transportation

임유경, 고민수[1], 이종민†
서울대학교; [1]삼성중공업
(jongmin@snu.ac.kr†)

CO2 carrier tanks must be cooled before loading liquid CO2 in order to prevent damage on tank wall. It is necessary to optimize the inlet and outlet purge flowrate as loss of CO2 gas in carbon capture and liquefaction. We propose a mathematical model of pre-cooling process of the CO2 storage tank. It is a nonlinear multi-input-multi-output system where the inlet mass flowrate of CO2 gas and the outlet purge mass flowrate of the same gas act as input variables to adjust tank pressure and temperature. We then design an off-line optimizing scheme to calculate optimal input sequence based on the model-predictive algorithm. This nonlinear optimization drives tank pressure and temperature from 300 kPa and 293.15K to 500 kPa and 243.15K within one day. A suboptimal way of determining the nonlinear terminal penalty is proposed. This work is supported by the Development of Standardization/Certification Technologies and Whole-Chain-Integrated Modules for CCS Commercialization Project (2012100201687) funded by the Korea Ministry of Trade, Industry & Energy (MOTIE).