Kathleen B. Aviso
Professor, Chemical Engineering Department
Gokongwei College of Engineering
De La Salle University, Manila, Philippines
Kathleen.aviso@dlsu.edu.ph

Biography

Kathleen B. Aviso is a University Fellow and a Professor of the Department of Chemical Engineering at De La Salle University, Manila, Philippines. She is also the current Dean of the Gokongwei College of Engineering of the university. Her main research interest is the development of decision support tools for environmental decision-making. She earned her Ph.D. degree in Industrial Engineering from De La Salle University. She is the author of more than 240 Scopus-indexed publications with an h-index of 32. She is currently an executive editor for the Journal of Cleaner Production (published by Elsevier), an associate editor for Digital Chemical Engineering, and the South African Journal of Chemical Engineering, and part of the editorial board of several other international journals published by Elsevier and Springer Nature. She is the author of the book Input-Output Models for Sustainable Industrial Systems. For her scientific work, Prof. Aviso has received multiple scientific awards from government and professional organizations in the Philippines.

Title: Game Theoretic Defense of Input-Output Systems

Abstract: Recent developments in digitalization have enhanced the interconnectedness of economic and industrial activities. Though this has brought about improved efficiency in industrial processes, it has also introduced new risks and vulnerabilities. Incidences of cyberattacks on industrial control systems for example have increased, with each incidence averaging millions of dollars in cost damages. The highly interdependent nature of systems such as supply chain networks, or highly optimized industrial complexes make them susceptible to cascading failures. There are different reasons for why terrorists or threat actors target enterprises, and defending against these threats is essential in ensuring the sustainability and efficiency of industrial operations. In this work, a hybrid Stackelberg-Leontief model for planning optimal defense measures for targeted interdependent systems is developed. The interdependence between system units is described using the input-output (IO) model. The IO model is then embedded within

a bilevel optimization problem or Stackelberg leader-follower game. Available defensive measures incur fixed resource costs for the defender regardless of whether an attack occurs or not. However, these defensive measures can mitigate loss and damage should an attack occur. The terrorist on the other hand, strategizes to select an attack which would result in the most damage in consideration of the measures put in place. The problem then is for the defender, who is considered as the leader, in anticipation of the potential action of the terrorist or follower, to select the optimal defense strategy given available resource constraints. Case studies are presented to demonstrate how the model can be implemented.