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Resilient Interconnection in Cyber-Physical Control Systems

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Abstract

Secure interconnection between multiple cyber-physical systems has become a fundamental requirement in many critical infrastructures, where security may be centralized in a few nodes of the system. These nodes could, for example, have the mission of addressing the authorization services required for access in highly-restricted remote substations. For this reason, the main aim of this paper is to unify all these features, together with the resilience measures so as to provide control at all times under a limited access in the field and avoid congestion. Concretely, we present here an optimal reachability-based restoration approach, capable of restoring the structural control in linear times taking into account: structural controllability, the supernode theory, the good practices of the IEC-62351 standard and the contextual conditions. For context management, a new attribute is specified to provide a more complete authorization service based on a practical policy, role and attribute-based access control (PBAC + RBAC + ABAC). To validate the approach, two case studies are also discussed under two strategic adversarial models.

Keywords:

Structural controllability, Cyber-Physical Systems, Interconnection, Access Control, Resilience, Redundancy

1. Introduction

Taking into account our earlier work [1, 2, 3], this paper presents a secure decentralized interconection system composed of a cost-effective, self-healing approach based on redundant

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