Reachability graph analysis is one of the most widely used techniques to verify the behaviour of asynchronous and concurrent systems modeled in Petri nets. Unfortunately, a state explosion problem is often the bottleneck when applying Petri net modeling and analysis to large and complex industrial systems. This paper proposes an approach in which Petri net slices are computed based on structural concurrency inherent in the P/T net and compositional reachability graph analysis is performed. Petri net slices are proven to provide behavioural equivalence to P/T nets. This approach may enable verification of properties such as boundedness and liveness which may fail on unsliced P/T nets due to a state explosion problem. Effectiveness and scalability of our approach is demonstrated using both dining philosophers and feature interaction problems found in telecommunication software.

Key words and Phrases: Petri nets, Place/Transition nets, reachability analysis, Petri net Slice, compositional analysis, structural concurrency.

Classification of the paper: Software-Software Engineering-Software/Program Verification-Formal Methods

1. INTRODUCTION

Petri nets are widely used to model and verify the behaviour of asynchronous systems (Suzuki et al, 1990), concurrent systems, and real-time systems (Ghezzi et al, 1991; Bucci and Vicario, 1995). Petri net-based formalisms have been significantly extended to enhance expressiveness and to