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**Broy et al.**

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(54) **AUTOMATICALLY GENERATING A PROGRAM**

6,282,681 B1 \* 8/2001 Sun et al. .... 714/738  
6,289,502 B1 \* 9/2001 Garland et al. .... 717/2

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**FOREIGN PATENT DOCUMENTS**  
EP 0 049 176 A1 7/1981  
EP 0 343 682 B1 5/1989

**OTHER PUBLICATIONS**

Jonsson, Compositional specification and verification of distributed systems, ACM, 1994, pp 259–303.\*  
Lampert, “A simple approach to specifying concurrent systems”, Comm. of the ACM, 1989, pp 32–45.\*  
Kung et al., “Object-oriented real time systems modeling and verification”, IEEE, 1997, pp 224–231.\*

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\* cited by examiner

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(57) **ABSTRACT**

A method, an apparatus and a computer program product are described for automatically generating a state-based program for a component of a system consisting of a plurality of components communicating with each other, wherein the program is generated from a specification of the system, the specification comprising interaction-based sequence descriptions of the system. According to the present invention, all sequence descriptions of said component are determined, the sequence descriptions are normalized, a state-based specification of said component is determined from the normalized sequence descriptions, and the state-based program for the component is determined from the state-based specification. The present invention facilitates the process of program development since the costly, manual development of a state-based program from the specification of a system is automated at least to a substantial degree.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,802,116 A \* 1/1989 Ward et al. .... 395/500  
5,721,926 A \* 2/1998 Tamura ..... 395/701  
5,828,829 A \* 10/1998 Yamauchi et al. .... 714/38  
5,946,490 A \* 8/1999 Lieberherr et al. .... 395/707  
6,002,869 A \* 12/1999 Hinckley ..... 395/704  
6,029,002 A \* 2/2000 Afifi et al. .... 395/707  
6,163,692 A \* 12/2000 Chakrabarti et al. .... 455/416  
6,260,186 B1 \* 7/2001 James ..... 717/1  
6,260,188 B1 \* 7/2001 Ungpiyakul et al. .... 717/1  
6,272,338 B1 \* 8/2001 Modzelesky et al. .... 455/426

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