

Table of Contents

1 Introduction	1
F. Mikosch	
2 Rational and Baseline of the Interrob Project	6
F. Mikosch	
3 The STEP Based InterRob Interface for Product Definition Data	8
U. Kroszynski	
3.1 Identification of Topical Areas for Data Exchange	10
3.2 The InterRob Application Protocol	14
4 Implementation of STEP Interfaces in InterRob	20
F. Høgberg et al.	
4.1 Data Exchange Between Commercial Systems using Physical Files	21
4.1.1 CATIA	21
4.1.2 ROPSIM.....	23
4.1.3 GRASP.....	24
4.1.4 KISMET.....	26
4.1.5 BRAVO/ROBOT.....	27
4.1.6 ADAMS	27
4.1.7 The STEP Processors for KISMET, BRAVO/ROBOT and ADAMS	27
4.2 Capability of the STEP Processors for KISMET, BRAVO and ADAMS	29
4.3 Data Exchange and Storage by Object Oriented Databases	30
4.3.1 Object-Oriented Databases.....	30
4.3.2 ObjectStore	31
4.3.3 STEP Programmer's Toolkit.....	31
4.3.4 InterRob Application.....	32
4.3.5 The Equipment database	33
4.3.6 Interfaces for Object-Oriented databases	36
5 Aspects of Model Fidelity	38
T. Horsch	
5.1 Motivation	38

VIII Table of Contents

5.2 Error compensation of robots	39
5.3 Spline Interpolation	45
5.3.1 Introduction.....	43
5.3.2 Rational motions	44
5.3.3 Construction of spline segment	46
6 Industrial Applications and Demonstrations of InterRob Results.....	49
P. Sorenti, H.C. Larsen, C. Sage	
6.1 The Plasma Spraying Application at Rolls-Royce.....	49
6.1.1 Introduction.....	49
6.1.2 Overview of Application.....	50
6.1.3 Description of the Demonstration	53
6.1.4 Results and Experiences.....	55
6.1.5 Future application and results	56
6.2 The Pipe Welding Application at Odense Steel Shipyard	57
6.2.1 Introduction.....	57
6.2.2 The Application	57
6.2.3 The Reis 6 Axis Robot with a Turn/Tilt Table.....	59
6.2.4 The GRASP Simulation System.....	61
6.2.5 The Laser Scanner.....	62
6.2.6 The InterRob Database.....	63
6.2.7 Description of the Demonstration	63
6.2.8 Benefits and Commercial Impact of Results	66
6.2.9 Future Application of Results.....	66
7 Contributions to Standardisation Activities	67
A. Ludwig, T. Horsch	
7.1 InterRob and the STEP Standardisation Work	67
7.1.1 The STEP Kinematics Model.....	69
7.1.2 Physical File Structure	70
7.1.3 STEP Data Access Interface	71
7.1.4 STEP Applications of Surface Modelling.....	71
7.1.5 The InterRob Specification	72
7.2 InterRob and the IRL Standardisation Work	72
8 InterRob Project Results and Exploitation Plans	74
K. Hasund et al.	
8.1 General	74
8.2 BYG Ltd.....	76

8.3 DTU	79
8.4 Forschungszentrum Karlsruhe	81
8.5 Odense Steel Shipyard (OSS).....	82
8.6 Reis Robotics.....	83
8.7 Rolls-Royce plc	83
8.8 SINTEF Informatics	84

Annexes

Annex 1	Proposed Extensions to STEP: Selected Parts of the InterRob Application Protocol U. Kroszynski, A. Ludwig, T. Sørensen	86
Annex 2	STEP Processors Developed in InterRob T. Sørensen.....	108
Annex 3	Simulation of Robot Kinetics and Control T. Horsch, U. Kroszynski	110
Annex 4	IRL Processors developed in InterRob P. Sorenti	114
Annex 5	Examples of STEP Exchange Files in InterRob F. Høgberg et al.	115
Annex 6	Examples of IRL Exchange Files in InterRob P. Sorenti	137
References		139