

Table of Contents

Chapter 1	Introduction	1
1.1	Background	1
1.2	Thesis Outline	2
Chapter 2	Aim of Research	4
Chapter 3	Literature Review	5
3.1	Studies Based on Conventional Method	5
3.2	Studies Based on CFD Method	9
3.3	Closure	11
Chapter 4	Approach Adopted	13
4.1	Development of NS Solver	13
4.2	Development of Hybrid Method	14
4.3	Closure	14
Chapter 5	NS Solver for Coupled Motion of Two-Phase Flow and Floating Body	16
5.1	Mathematical Model	16
5.1.1	Governing Equations of Fluid Motion	16
5.1.2	Governing Equations of Rigid Body Motion	17
5.2	Numerical Method	18
5.2.1	Calculation of Fluid Field	18
5.2.2	Calculation of Body Motion	21
5.2.3	Dynamic Mesh Strategy	22
5.2.4	Solution Procedure	23
5.3	Closure	24
Chapter 6	Hybrid Method for Damaged Ship Flooding in Waves	25
6.1	Mathematical Model	25



6.1.1	Reference Coordinate System	25
6.1.2	External Forces Acting on a Ship	25
6.1.3	Wave Excitation Force	26
6.1.4	Radiation Force	28
6.1.5	Buoyancy Force	29
6.1.6	Internal Liquid Load	30
6.1.7	Governing Equation of Ship Motion	31
6.2	Numerical Method	32
6.3	Closure	33
Chapter 7	Primary Test Cases of Free Surface Flow	35
7.1	Dam Break Problem	35
7.1.1	2-D Dam Break	35
7.1.2	3-D Dam Break	43
7.2	Tank Sloshing Problem	50
7.3	Compartment Flooding Problem	58
7.4	Closure	62
Chapter 8	Damaged Ship Flooding in Calm Water	64
8.1	Summary of Benchmarking Cases	64
8.2	2-D Compartment Flooding Case	67
8.3	Fixed Barge Flooding Case	73
8.4	Floating Barge Flooding Case	80
8.5	Closure	88
Chapter 9	Damaged Ship Flooding in Waves	89
9.1	Description of Test Ship	89
9.2	Roll Decay Test	91
9.2.1	Case for Intact Ship	91
9.2.2	Case for Damaged Ship	91
9.3	Ship Motion in Beam Seas	98
9.3.1	Case for Intact Ship	98
9.3.2	Case for Damaged Ship	99

9.3.3 Effect of Water Ingress/Egress	112
9.4 Closure	120
Chapter 10 Discussion	122
10.1 Summarizations of Present Work	122
10.2 Recommendations for Future Work	124
Chapter 11 Conclusions	127
References	128