

8527607

Lotfi, Vahid

ANALYSIS OF THE RESPONSE OF DAMS TO EARTHQUAKES

The University of Texas at Austin

Ph.D. 1985

University
Microfilms
International 300 N. Zeeb Road, Ann Arbor, MI 48106

TABLE OF CONTENTS

Acknowledgements	iv
Abstract	v
Chapter 1	1
Introduction	1
1.1 Review of Previous Work	1
1.2 Scope of the Dissertation	7
Chapter 2	9
Analysis of Dam-Reservoir Systems	9
2.1 Dam	9
2.2 Reservoir	12
2.2.1 Algebraic Eigenvalue Problem	15
2.3 Vertical Upstream Face, Horizontal Bottom	19
2.3.1 Fluid Hyperelement	19
2.4 Arbitrary Geometry in a Neighborhood of the Dam	24
2.4.1 Fluid Finite Element	26
2.4.2 Auxiliary Interface Element	28
2.4.3 Fluid Hyperelement	32
Chapter 3	34
Analysis of Dam-Reservoir-Foundation Systems	34
3.1 Solid Hyperelement	34
3.2 Vertical Upstream Face	36
3.2.1 Fluid-Solid Hyperelement	51
3.3 Arbitrary Shape of Upstream Face of the Dam	52
3.3.1 Fluid-Solid Hyperelement	63
	63
Chapter 4	66
Application to Concrete Gravity Dam	66
4.1 System Geometry, Transfer Functions, and Characteristic Frequencies	66
4.1.1 System Geometry	66
4.1.2 Transfer Functions	68
4.1.3 Characteristic Frequencies	69
4.2 Dam	71
4.3 Dam-Reservoir	72
4.3.1 Dam-Reservoir Interaction	76
4.3.2 Effect of the Normalized Depth of the Reservoir	82
4.3.3 Effect of the Normalized Characteristic Frequency of the Reservoir	86
4.4 Dam-Reservoir-Foundation System	90
4.4.1 Effect of the Normalized Depth of the Foundation	90

4.4.2 Effect of the Ratio of the Elastic Moduli	103
4.4.3 Reservoir-Foundation Interaction	113
Chapter 5	125
Effect of Sediments on the Response of Concrete Gravity Dams	125
5.1 Effect of the Normalized Depth of the Sediment	129
5.2 Comparison with Approximate Methods	129
5.3 Effect of Damping	133
5.4 Effect of the Ratio of the Elastic Moduli	146
5.5 Simultaneous Effect of Sediments and Flexible Foundation	150
Chapter 6	156
Application to Earth Dams	156
6.1 Effect of the Shape of the Upstream Face	156
6.2 Dam-Reservoir System	165
6.3 Dam-Reservoir-Foundation System	171
6.3.1 Effect of the Normalized Depth of the Foundation	171
6.3.2 Comparison with Approximate Methods	182
Chapter 7	189
Summary and Conclusions	189
References	194
Vita	198