



The Welding Engineer's Guide to Fracture and Fatigue

Philippa Moore and Geoff Booth

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*Philippa would like to dedicate this book to her family, especially her children
Rosie and Jonas.*

Geoff would like to dedicate this book to his family.

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Preface

Welding engineering is a discipline that many engineers find themselves moving into only once they begin to specialise within their career, because it is not a common area to study at college or university. Some begin as welders but later wish to acquire the knowledge to become welding supervisors, welding inspectors or welding engineers. Others are tempted to consider a career change by the potential opportunities offered by welding engineering, or simply by curiosity of this broad and industrially significant subject. Whatever the reason that has caused you to begin to read this book, we hope to inform and enlighten you into some of the aspects of fracture and fatigue that must be understood in order to become a welding engineer.

No prior knowledge of the subjects of fracture and fatigue is assumed and the concepts are explained from first principles. Unless absolutely necessary, we avoid using mathematical formulae to explain concepts as much as possible. We hope that to learn more about fracture or fatigue as subjects in their own rights you use the lists of further reading given at the end of each chapter. Both fracture and fatigue are fields where there are many academic textbooks and large amounts of ongoing research. However, this book is for welding engineers, and we have selected those parts of these topics which relate specifically to welds, and are valuable for a welding engineer, particularly in their discussions with fatigue designers or fracture mechanics experts. Part One covers the basic principles and includes descriptions of typical welding defects and how these defects behave in structures under static and cyclic loading, potentially leading to premature failure. Part Two then provides guidance on how to avoid such failures, through selection of appropriate materials, welding procedures and inspection regimes for the intended service conditions. The technical content is relevant to all welded engineering structures, including pipelines, fixed and floating offshore platforms, bridges, buildings, ships, pressure vessels and off highway vehicles. Each chapter may be read independently, and gives references to other chapters when further relevant information is found in other parts of the book.

This book is written with the intention of accompanying the Design and Construction modules of the IIW Welding Diploma at all levels, to provide all the information on fracture, fatigue, and related topics in the syllabus. The authors have taught the Design and Construction modules at TWI in Cambridge for several years and decided to write this book to give extra support to those students, and to others worldwide. We have included the topics that students at the higher levels of Technologist and Engineer need, although Specialist level students would not be expected to know the material in Chapters 5, 11 and 12. The descriptions of testing and inspection methods in Chapters 9 and 10, though not strictly necessary for the Design and Construction module, are required in other modules of the Diploma, and have been included to make the whole book more complete in itself. We are grateful

to TWI Ltd for their support in writing this book, and for permission to use many of its corporate images to illustrate the chapters. We also thank many of our friends who have helped along the way with sourcing the images and reviewing chapters.

We hope you find our book to be a helpful resource in your study of welding engineering.

Philippa Moore and Geoff Booth
2014

Contents

Woodhead Publishing Series in Welding and Other Joining Technologies	xi
Preface	xvii

Part One	Principles of weld fracture and fatigue	1
1	Designing engineered structures	3
1.1	Introduction	3
1.2	The first engineered structures	3
1.3	Successful structures	5
1.4	Materials and fabrication methods	6
1.5	Industrialisation: benefits and consequences	7
1.6	Conclusions	10
1.7	Sources of further information and advice	10
2	Structures under load	11
2.1	Introduction	11
2.2	Sources of loading	11
2.3	Types of loading	13
2.4	Loads experienced during construction	15
2.5	Design approach	16
2.6	Axial and bending stresses	17
2.7	Conclusions	20
2.8	Sources of further information and advice	21
3	Welding problems and defects	23
3.1	Introduction	23
3.2	'Workmanship' defects	24
3.3	Weldability	27
3.4	Fabrication cracking in welds	28
3.5	Other types of weld defect	31
3.6	Welding residual stresses	32
3.7	Distortion	34
3.8	Conclusions	35
3.9	Sources of further information and advice	35
4	Design for static loading	37
4.1	Introduction	37
4.2	Load-extension curves	37

4.3	Stress-strain curves	38
4.4	Static limit state design	41
4.5	Conclusions	42
4.6	Sources of further information and advice	43
5	Brittle fracture and the behaviour of cracks in structures	45
5.1	Introduction	45
5.2	Nature of brittle fracture	45
5.3	The three factors for brittle fracture	46
5.4	Ductile-to-brittle transition	47
5.5	Welding and fabrication codes	49
5.6	Principles of fracture mechanics	51
5.7	Fracture toughness parameters	60
5.8	Conclusions	62
5.9	Sources of further information and advice	62
6	Structures under cyclic load	65
6.1	Introduction	65
6.2	Engineering perspective of fatigue	66
6.3	Metallurgical perspective of fatigue	70
6.4	Practical implications for a growing fatigue crack	72
6.5	Conclusions	73
6.6	Sources of further information and advice	73
7	Fatigue of welded joints	75
7.1	Introduction	75
7.2	Fatigue performance of welded joints	75
7.3	Special features of welded joints	77
7.4	Fatigue design of welded joints	83
7.5	Stress histories of real structures: variable amplitude loading	88
7.6	Fatigue of welded aluminium	93
7.7	Conclusions	93
7.8	Sources of further information and advice	94
8	Failure modes and analysis in metals	95
8.1	Introduction	95
8.2	Ductile failure	95
8.3	Brittle fracture	96
8.4	Fatigue failure	100
8.5	Scanning electron microscopy (SEM) of fracture surfaces	103
8.6	Interpreting fracture faces	104
8.7	Corrosion	107
8.8	Engineering failure investigations	108
8.9	Conclusions	109
8.10	Sources of further information and advice	110