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14 Design of Shape Memory  
15 Alloy (SMA) Actuators

16





## Preface

84 Shape memory alloys have been fascinating to designers, architects, and researchers  
85 in the past decade. There is something about the uncanny ability of seemingly  
86 inanimate wires suddenly reacting to external nonmechanical stimulus that evokes  
87 curiosity and childlike fascination in everyone. However, commercial applications  
88 (other than in the medical field) has been slow. Part of the reason is the lack of  
89 accessible explanations that allow people with only basic exposure to such mate-  
90 rials to carry out designs that are viable.

91 Too often, papers and books written (many by the authors themselves) about  
92 arcane aspects of SMA behavior are not meant for designers. This leads to exas-  
93 peration from a designer who wants us to “tell me how do I design with this?”

94 This book seeks to provide an accessible account of SMA behavior together with  
95 examples of preliminary design methodology to students with a basic undergrad-  
96 uate background. The aim is to provide an “on ramp” to explore the unique  
97 properties of these devices, and so the book only deals with the “bare necessities”  
98 and ignores many nuances including important issues of functional fatigue. Rather  
99 the design recommendations are based on being conservative and making design  
100 decisions that will eliminate the need for considering such issues at the expense of  
101 not being optimal. Our philosophy in designing with SMA is “robust, repeatable,  
102 guaranteed behavior” over “optimal” response.

103 This monograph is by no means extensive but just an introduction and an  
104 invitation to the readers to explore the behavior of these materials. It grew out of a  
105 National Science Foundation Grant to develop “strength of materials-like”  
106 approaches to shape memory wires and springs. While the current applications at  
107 the cutting edge have moved on to tubes, plates, and so on, the commercial  
108 availability of wires and springs for common devices has grown quite a bit and this  
109 is what we wish to emphasize.



110 If a reader gains a qualitative understanding of SMA response together with the  
111 ability to do a “first-cut” design by reading this book and is able to go on to explore  
112 SMA better, then we have succeeded in achieving our purpose of writing this book.

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