

Table of Contents

Preface	11
-------------------	----

Chapter 1 Mathematical Modelling – An Overview

1.1 Introduction	15
1.2 Modelling objectives	17
1.3 Model categories	21
1.4 A potted history	22
1.5 Conclusion	24

Chapter 2 A Real Model Exposed

2.1 Introduction	26
2.2 Pelletising of iron ore	26
2.3 Mechanisms of green pellet growth	32
2.4 A conceptual view of the process	36
2.5 Some initial attempts at modelling	38
2.6 A practical model	42
2.7 Model results and discussion	45
2.8 Conclusions	51

Chapter 3 Teaching Mathematical Modelling – A Salutary Experience

3.1 Introductory remarks	55
3.2 The main problem	57
3.3 Student performance	58
3.4 Teacher's basic model	60
3.5 Teacher's complex model	61
3.6 Recapitulation	62
3.7 Teacher's general comments	64

Chapter 4 The Art of Mathematical Modelling I – The process of mathematical modelling

4.1	Introduction	66
4.2	The process of mathematical modelling	67
4.3	The gestation stage	68
4.4	The model building stage	69
4.5	The simulation stage	70
4.6	The pay-off stage	71
4.7	Some hints	72
4.8	Conclusion	73

Chapter 5 The Art of Mathematical Modelling II – An approach to the teaching of mathematical modelling

5.1	Introduction	74
5.2	Reorientation	74
5.3	What we are attempting to achieve	76
5.4	A philosophical approach	76
5.5	A teaching programme	78
5.6	Teacher's role and assessment	85
5.7	A salutary experience revisited	88

Chapter 6 The Mathematical Models

6.1	Background notes	91
6.2	Buying apples	91
6.3	Economics of moving icebergs	94
6.4	Estimating the true cost of a mortgage	101
6.5	Minimising water pollution	107
6.6	Augmenting an interactive computing system	120

Chapter 7 Computer Software to Support the Teaching of Mathematical Modelling

7.1	Introduction	129
7.2	Development philosophy	130
7.3	Continuous model simulation	130
7.4	IPSODE – Interactive Programming with Systems of Ordinary Differential Equations	131
7.5	Discrete simulation	139
7.6	APHIDS – A Program to Help Interactively in Discrete Simulation	142
7.7	Conclusion	146

Chapter 8 Conclusions

8.1	What use is the course?	148
8.2	Sources of further material and academic groups	149
8.3	How does the course blend with existing mathematical degree schemes?	151
8.4	A new approach to mathematics degree courses.	152
Index		154