1. Record Nr. UNINA9910821508103321

Autore	Al-Khoury Rafid
Titolo	Computational modeling of shallow geothermal systems / / Rafid Al-Khoury
Pubbl/distr/stampa	Boca Raton, [FL], : CRC Press, c2012
ISBN	1-138-07342-3 0-429-16576-5 1-280-12250-1 9786613526366 1-4398-6286-9 1-4665-1267-9
Edizione	[1st ed.]
Descrizione fisica	1 online resource (246 p.)
Collana	Multiphysics modeling, , 1877-0274 ; ; v. 4
Classificazione	SCI019000TEC010000TEC031010
Disciplina	621.402/5
Soggetti	Heat exchangers - Thermodynamics Heat - Transmission - Mathematical models Heat equation Ground source heat pump systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	"A Balkema book."
Nota di bibliografia	Includes bibliographical references (p. 221-224) and indexes.
Nota di contenuto	Front Cover; About the book series; Editorial board of the book series; Dedication; Contents; Preface; Part I: Preliminaries; 1. Introduction; 2. Heat transfer; 3. Heat transfer in porous media; 4. Heat transfer in borehole heat exchangers; 5. Thermal resistance; Part II: Analytical and semi-analytical modeling; 6. Eigenfunction expansions and Fourier transforms; 7. Laplace transforms; 8. Commonly used analytical models for ground-source heat pumps; 9. Spectral analysis of shallow geothermal systems; 10. Spectral element model for borehole heat exchangers; Part III: Numerical modeling 11. Finite element methods for conduction-convection problems12. Finite element modeling of shallow geothermal systems; References
Sommario/riassunto	Geothermal heat is a viable source of energy and its environmental impact in terms of CO2 emissions is significantly lower than conventional fossil fuels. Shallow geothermal systems are increasingly

utilized for heating and cooling of buildings and greenhouses. However, their utilization is inconsistent with the enormous amount of energy available underneath the surface of the earth. Projects of this nature are not getting the public support they deserve because of the uncertainties associated with them, and this can primarily be attributed to the lack of appropriate computational tools necessary to carry out effective designs and analyses. For this energy field to have a better competitive position in the renewable energy market, it is vital that engineers acquire computational tools, which are accurate, versatile and efficient. This book aims at attaining such tools. This book is the first of its kind. It addresses computational modeling of shallow geothermal systems in considerable details, and provides researchers and developers in computational mechanics, geosciences, geology and geothermal engineering with the means to develop computational tools capable of modeling the complicated nature of heat flow in shallow geothermal systems in rather straightforward methodologies. Coupled conduction-convection models for heat flow in borehole heat exchangers and the surrounding soil mass are formulated and solved using analytical, semi-analytical and numerical methods. Background theories, enhanced by numerical examples, necessary for formulating the models and conducting the solutions are thoroughly addressed.The book concentrates on two main aspects: mathematical modeling and computational procedure. In geothermics, both aspects are considerably challenging because of the involved geometry and physical processes. However, they are highly stimulating and inspiring. A good combination of mathematical modeling and computational procedures can greatly reduce the computational efforts. This book thoroughly treats this issue and introduces step-by-step methodologies for developing innovative computational models, which are both rigorous and computationally efficient. The book is structured in three parts: Part I: preliminaries (chapters 1-5); Part II: analytical and semi-analytical modeling (chapters 6-10); and Part III: numerical modeling (chapters 11-12)--

Geothermal heat is a renewable source of energy offering a number of advantages over conventional fossil fuel resources, particularly its environmental impact in terms of CO2 emissions is significantly lower. Shallow geothermal energy is considered as one of the alternative energy resources and has been widely utilized for heating of buildings and greenhouses, using borehole heat exchangers (BHE). This book presents innovative computational modeling of shallow geothermal systems consisting of borehole heat exchangers embedded in a soil mass--