Contents

1	Introduction				
	1.1	Motivation	2		
	1.2	Aim and Scope	4		
	1.3	General Background	7		
		1.3.1 Law of Motive Force	7		
		1.3.2 Conservation Principle	11		
		1.3.3 Variational Formulation	15		
		1.3.4 Fermat's Principle	18		
		1.3.5 Constructal Law	20		
		1.3.6 Entropy Generation Minimization	22		
		1.3.7 Method of Intersecting Asymptotes	24		
		1.3.8 Principle of Equipartition	28		
	Refe	erences	36		
2	Con	ductive Heat Transport Systems	47		
	2.1	The Tropicing Control of the Control	47		
	2.2	A Physical Principle in Heat Transport	49		
	2.3	The Physical Basis for Extremum Heat Transfer	51		
	2.4	Temperature Distribution and Heat Transfer from			
			53		
	2.5	Insulation on Plane Surface with Static Wall Temperature			
		Condition	54		
	2.6	Insulation on Cylindrical Surface with Static			
		Wall Temperature Condition	56		
	2.7	Insulation on Cylindrical Surface with Dynamic			
		Wall Temperature Condition	58		
	2.8	Law of Motive Force, Tangent Law, Fermat's Principle,			
		and Constructal Law	59		
	2.9	Discussions	62		
	Refe	erences	63		
3	Con	njugate Heat Transport Systems	67		
	3.1	The Problem	67		
	3.2	The Physical Model	69		

xxi

xxii Contents

	3.3	Optimization with Assumed Variation of Heat	70			
	3.4	Transfer Coefficient Optimization with Unknown Variation of Convective	70			
	3.4	Heat Transfer Coefficient	72			
	3.5	Bounds of Insulation Volume	76			
	3.6		70 77			
		Insulation with Tapered Profile	//			
	3.7	Law of Motive Force and Commonality of Nature	70			
		of Optimizations	79			
	3.8	Discussions	80			
	Refe	erences	81			
4	Fluid Flow Systems					
	4.1	The Problem	83			
	4.2	Elemental Fermat Type Flow	85			
	4.3	Integral Fermat Type Flow	92			
	4.4	First Geometrical Construct in a Shear Flow	94			
	4.5	Discussions	96			
	Refe	erences	97			
5	Natural Heat Engine					
•	5.1	The Problem	101			
	5.2	The Physical Model	103			
	5.3	Control Volume Formulation of a Single	103			
	3.3	Thermoelectric Element	105			
	5.4	Control Volume Formulation for the Complete	105			
	J. T	Thermoelectric Device	111			
	5.5	Consequences of Equipartitioned Joulean Heat	115			
	5.6	Discussions	117			
		erences	118			
	Keit	stences	110			
6	Rea	l Heat Engine	121			
	6.1	The Problem	121			
	6.2	The Physical Model	124			
	6.3	The Optimization Method	127			
	6.4	Numerical Examples	135			
	6.5	Discussions	137			
	Refe	erences	138			
A I		the Author	141			
	JULL I	HIV AUGUST	14 L			