

Contents

1	Introduction	1
1.1	Well-Posedness of the Cauchy Problem	1
1.2	Symmetric Hyperbolic Systems	5
1.3	Systems Which Are Not Symmetrizable	12
1.4	Lax-Mizohata Theorem	18
1.5	Levi Condition	22
1.6	A Lemma on Hyperbolic Polynomials	26
2	Necessary Conditions for Strong Hyperbolicity	31
2.1	Necessary Conditions for Strong Hyperbolicity	31
2.2	Key Propositions	33
2.3	Proof of Theorem 2.1 (Simplest Case)	37
2.4	Proof of Theorem 2.1 (General Case)	44
2.5	Proofs of Propositions 2.4 and 2.5	50
2.6	Proof of Key Proposition	55
2.7	Proof of Key Proposition, Asymptotic Diagonalization	63
2.8	Involutive Characteristics	71
2.9	Localization at Involutive Characteristics	75
2.10	Concluding Remarks	82
3	Two by Two Systems with Two Independent Variables	85
3.1	Reduction to Almost Diagonal Systems	85
3.2	Nonnegative Real Analytic Functions	90
3.3	Well-Posedness and Pseudo-Characteristic Curves	92
3.4	Strongly Hyperbolic 2×2 Systems	96
3.5	Nonnegative Functions and Newton Polygons	98
3.6	Behavior Around Pseudo-Characteristic Curves	104
3.7	Proof of Proposition 3.2	108
3.8	Energy Estimates Near Pseudo-Characteristic Curves	112
3.9	Energy Estimates of Higher Order Derivatives	121
3.10	Weighted Energy Estimates	125
3.11	Conditions for Well-Posedness	136

3.12	Construction of Asymptotic Solutions	142
3.13	Proof of Necessity	150
3.14	Equivalence of Conditions	153
3.15	Concluding Remarks	160
4	Systems with Nondegenerate Characteristics	161
4.1	Nondegenerate Characteristics	161
4.2	Nondegenerate Double Characteristics	169
4.3	Symmetrizability (Special Case)	174
4.4	Stability and Smoothness of Nondegenerate Characteristics	179
4.5	Symmetrizability (General Case)	194
4.6	Well Posed Cauchy Problem	209
4.7	Nondegenerate Characteristics of Symmetric Systems	213
4.8	Hyperbolic Perturbations of Symmetric Systems	216
4.9	Stability of Symmetric Systems Under Hyperbolic Perturbations	221
4.10	Some Special Cases	225
4.11	Concluding Remarks	229
	References	231
	Index	235

<http://www.springer.com/978-3-319-02272-7>

Hyperbolic Systems with Analytic Coefficients

Well-posedness of the Cauchy Problem

Nishitani, T.

2014, VIII, 237 p., Softcover

ISBN: 978-3-319-02272-7