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Identification via the Broadcast Channel	
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Channels with Cooperation Links that May Be Absent	
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Capacity Region of the Broadcast Channel with Two Deterministic Channel State Components	
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The Capacity Region of a New Class of K-Receiver Degraded Compound Broadcast Channels	
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Topics in Distributed Storage

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On Block Security of Regenerating Codes at the MBR Point for Distributed Storage Systems	
Hoang Dau (Singapore University of Technology and Design, Singapore), Wentu Song (Singapore University of Technology and Design, Singapore), Chau Yuen (Singapore University of Technology and Design, Singapore)	1967
Repair Locality From a Combinatorial Perspective	1907
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On a Duality Between Recoverable Distributed Storage and Index Coding	
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