Section I. Introduction
I-A. Review: 6G Vision
— I-B. 6G Beam Management
I-C. Survey Scope and Contributions
1-c. Survey scope and contributions
Section II. Overview on Conventional Beam Management
— II-A. Beam Management in 3GPP NR
II-B. Beam Management in IEEE
⊢ BFT in IEEE 802.11ad
— BFT in IEEE 802.11ay
BFT in IEEE 802.15.3c
II-C. Related Survey Papers
in C. Related Survey Lupers
Section III. Enabling-technology-based 6G Beam Management: State-of-the-Art
III-A. Technology Enablers
├─ Why AI?
Why ISAC?
Why RIS?
III-B. AI-Empowered Beam Management
Independent Training
Collaborative Training
III-C. Beam Management for ISAC Systems
⊢ Radar Sensing
— Communication Signal Sensing
C&S Hybrid Signal Sensing
Hiring Dedicated Sensors
III-D. Beam Management for RIS-Enhanced Systems
☐ Beam Sweeping-based Methods
— AI-driven Methods
Sensing-aided Methods
III-E. Lessons Learned: Summary and Insights
Section IV. Challenges and Open Issues
— IV-A. AI-Empowered 6G Framework
— Collaborative Edge AI
Sensing AI
Model Generalization
Life Cycle Management
— IV-B. ISAC-Enabled 6G Framework
 Radar-Type ISAC Implementation
— DMG Sensing
 Collaborative Sensing
Supported by RIS
IV-C. RIS-Enhanced 6G Framework
Support for Mobility
— Multi-Cell Multi-RIS
— Multi-User and MIMO
Bring in Active Ability
IV-D. THz Beam Management Towards 6G
Section V. Conclusion