



# Anti-Eavesdropping Using Smart Piloting, Multiple Transmit Antennas And Transmit Beamforming

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## OTHER INFORMATION

### KEYWORDS

wireless network, cyber-physical  
security, cybersecurity, network  
security, anti-eavesdropping, duplex  
radio, full-duplex, half-duplex

### CATEGORIZED AS

- ▶ **Communications**
  - ▶ Networking
  - ▶ Wireless
- ▶ **Computer**
  - ▶ Security
- ▶ **Security and Defense**
  - ▶ Cyber security

### RELATED CASES

2022-868-0

**PATENT STATUS**

| Country                  | Type                  | Number      | Dated      | Case     |
|--------------------------|-----------------------|-------------|------------|----------|
| United States Of America | Published Application | 20240031118 | 01/25/2024 | 2022-868 |

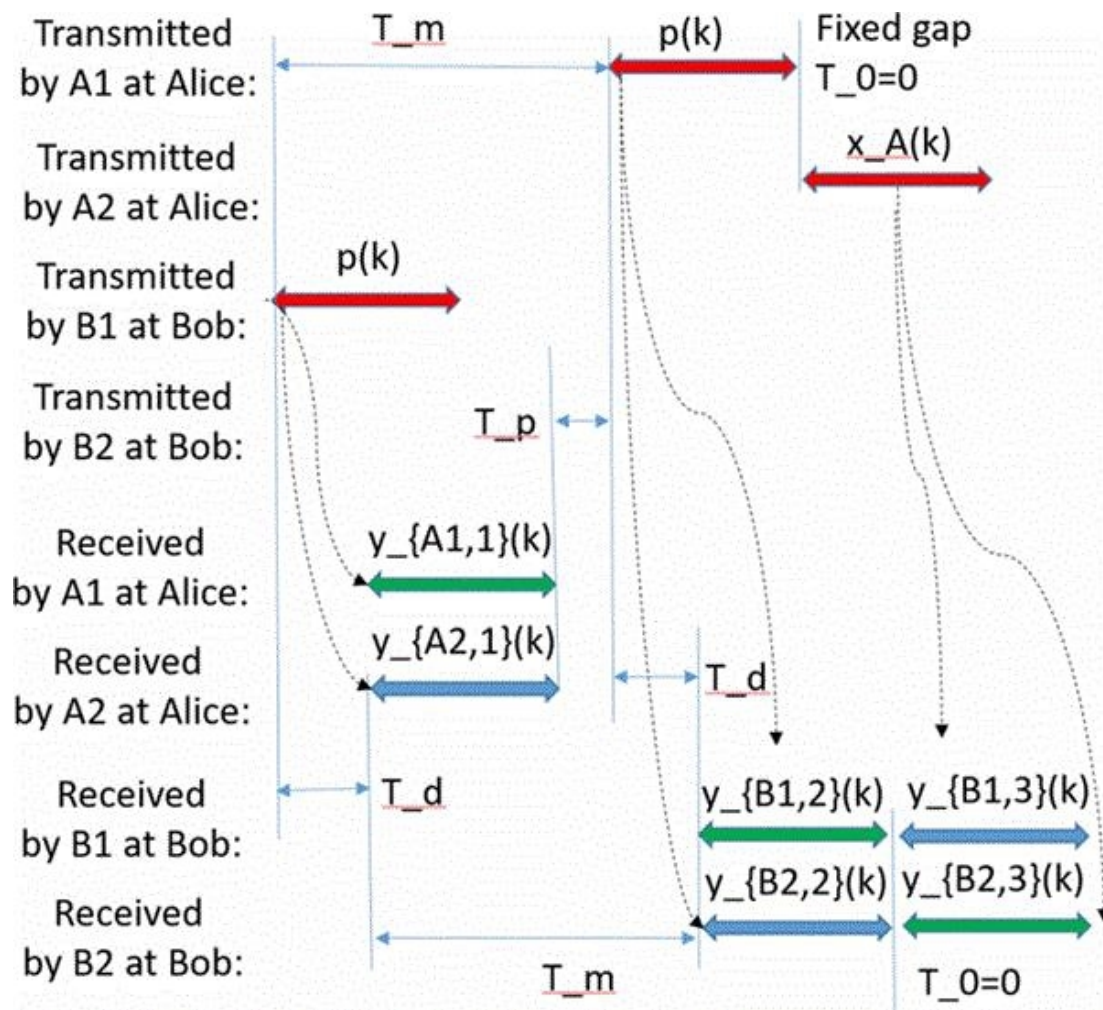
**FULL DESCRIPTION**

**Background**

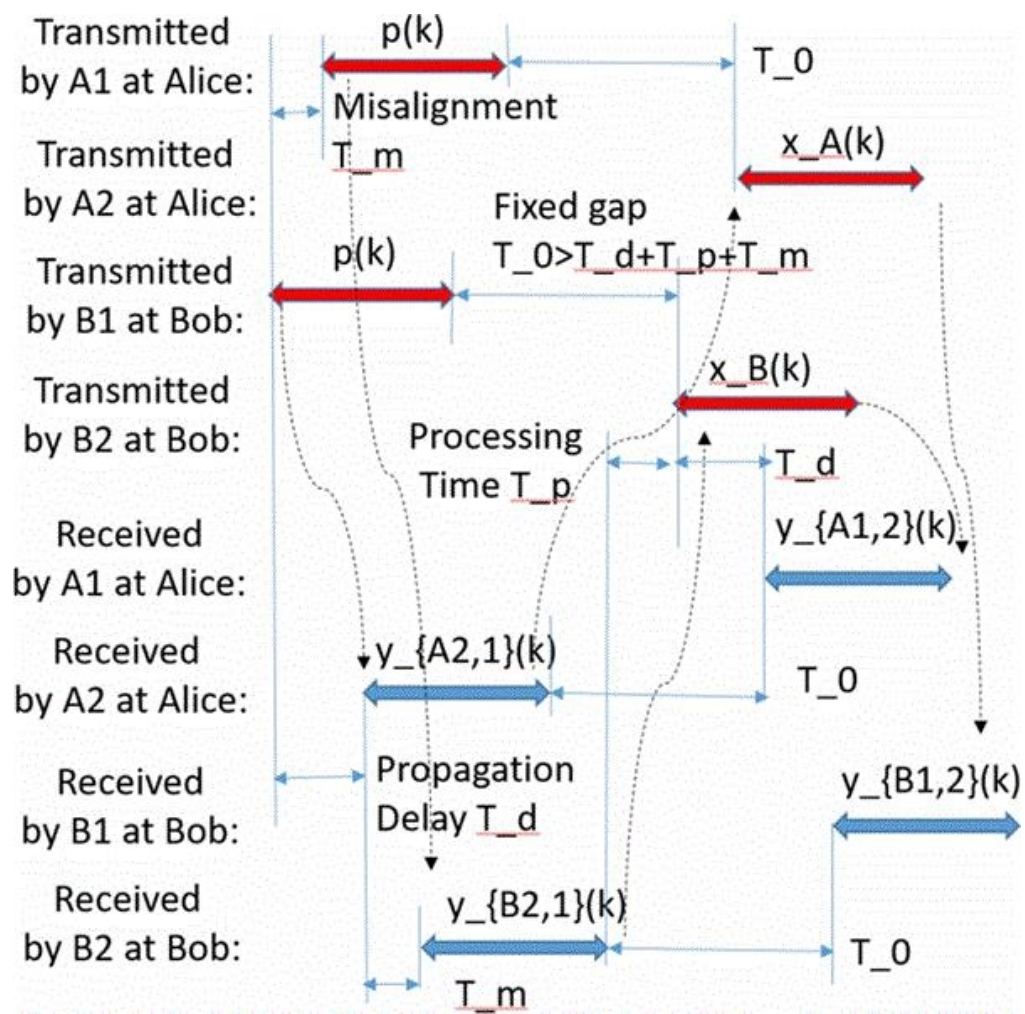
Channel state information in wireless networks is important to adapt optimize the transmitted signal as well as boost its reliability. The addition of physical layer security to cryptography based security is to prevent eavesdroppers from getting their receive channel state information with respect to a source node transmitting secret information. One such scheme, anti-eavesdropping channel estimation (ANECE), exploits a unique property of full-duplex radios by letting two or more cooperative nodes transmit concurrently to each other - specially designed pilots. The requirement of ANECE is keeping the distance between the two nodes relatively small compared to potential eavesdroppers.

**Technology**

Prof. Yingbo Hua has designed two new schemes of ANECE - ANECE-2 (for full-duplex radios) and ANECE-3 (for half-duplex radios). ANECE-3 could be the first flexible scheme that allows legitimate users to conduct radio frequency (RF) synchronization, necessary channel estimation and the detection of transmitted information while at the same time preventing any eavesdropper **at any location** from finding its channel state information relative to any transmit antenna where secret information is transmitted.



**ANECE-2: A modification of ANECE using antenna-isolation based full-duplex radios. The curved arrows indicate the causality.**



**ANECE-3: A 3-phase ANECE using half-duplex radios for secure information transmission from Alice to Bob**

**ADVANTAGES**

The benefits of the two implementations are:

- ▶ In ANECE-2, good alignment between the two pilots (from legitimate users) are not needed - the two pilots could be significantly misaligned.
- ▶ ANECE-3 is easy to implement since there is no strict requirement of synchronization between two distributed radios.
- ▶ ANECE-3 is the first feasible scheme, when only half-duplex radios are available - that allows secure exchange of information even with an eavesdropper at, virtually, any location.
- ▶ ANECE-3 does not require carrier synchronization.

**SUGGESTED USES**

Important for applications, where secure communication of information is important - such as in:

- ▶ Wireless networks
- ▶ Telecommunications
- ▶ Radio & video broadcasts

**INVENTOR INFORMATION**

- ▶ Please visit [Prof. Hua's lab group website](#) to learn more about their research
- ▶ Please review [all inventions by Prof. Hua and his team](#) at UCR.
- ▶ Please read [recent press coverage](#) of Prof. Hua.

**RELATED MATERIALS**

- ▶ [Anti-Eavesdropping Channel Estimation Using Multi-Antenna Half-Duplex Radios](#)

**RELATED TECHNOLOGIES**

- ▶ [Continuous Encryption Functions For Biometric Based Information Security Over Networks And Other Applications](#)

- ▶ Closed Loop Radio Interference Cancellation
- ▶ All-Analog Radio Interference Cancellation using CAPS Method
- ▶ Novel Solutions to Wireless Network Efficiency

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