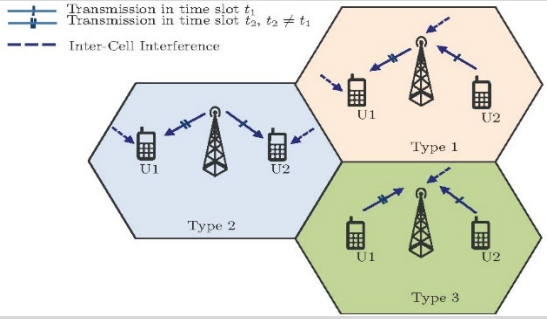
Dynamic Time-Frequency Division Duplex

PHYSICAL SCIENCES: Electronics

The Challenge	One of the key requirements for the success of 5G wireless network is efficient utilization of scarce resources depending on traffic demand. Both the time-division duplex (TDD) and the frequency-division duplex (FDD) schemes have the disadvantage of static allocation of time/frequency resources. On the other hand, all the current proposed schemes for dynamic-TDD/FDD require full knowledge at the base station of the interferences coming from all other users and base stations in the cellular network, which is impossible to acquire. Moreover, in these schemes, the weak uplink transmissions at base-stations suffer from strong interference caused by the stronger downlink transmissions from other base-stations.
The Solution	In this invention, we introduce dynamic time-frequency-division duplex (D-TFDD), which is a novel duplexing scheme that combines TDD and FDD, and yields significant performance gains compared to TDD and FDD schemes. 
Key benefits	• No requirement for inter-cell interference knowledge • No requirement for cooperation between base stations • Significant performance gains in terms of increased reliability and data rates per user • Achieves double the diversity gain compared to existing TDD/FDD schemes • Weak uplink transmissions at base-stations do not suffer from strong interference caused by the stronger downlink transmissions from other base-stations, a problem present in current D-TDD schemes.
Development Stage	Technology Concept – simulation work complete
Brief Description & Differentiation	In D-TFDD, a user receives from the base station (BS) on the downlink in one frequency band and transmits to the BS on the uplink in another frequency band, as in FDD. Next, the user shares its uplink transmission (downlink reception) on the corresponding frequency band with the downlink reception or the uplink transmission of another user in a D-TDD fashion. Hence, in a given frequency band, the BS communicates with user 1 (U1) and user 2 (U2) in a D-TDD fashion, and selects the stronger of the two users for communication in a given time slot. This selection of the stronger channel between two independent channels leads to double the diversity gain compared to existing TDD/FDD schemes, which results in huge performance gains in terms of increased reliability and data rates per user.
Research Team	Dr Nikola Zlatanov and Mohsen Razlighi
Intellectual Property	Australian Provisional Patent application filed
Key Publications	https://arxiv.org/abs/1909.03058

Potential Applications:

- Any wireless communication systems where two or more users communicate with an access point, such as existing cellular and wi-fi networks.

Proposed Next Development steps:

- A license opportunity for the telecommunication companies to validate the technology