32nd URSI GASS, Montreal, 19-26 August 2017

A Survey of Spectrum Sharing Techniques for Radar Systems

Mina Labib*(1), Vuk Marojevic(1), Anthony Martone(2), Jeffrey H. Reed(1), and Amir I. Zaghloul(1, 2)
(1) Bradley Department of Electrical and Computer Engineering, Virginia Tech, Blacksburg, VA, USA
(2) US Army Research Laboratory, Adelphi, MD, USA

1. Extended Abstract

Despite the dense allocation of radio frequency (RF) spectrum to different services and systems and the ever-increasing need for more bandwidth, recent studies have shown that RF frequency bands are sparsely used [1]. The concept of spectrum sharing has gained lots of interest recently in order to help improving spectrum utilization. Spectrum sharing implies that two or more users (using different technologies) can share the spectrum and use it as needed and available without creating harmful interference to one another. There are two main models of spectrum sharing. In the first model, one of the users has the priority access to the spectrum. This type of user is called Primary User (PU). Any other user sharing the spectrum with the PU is called Secondary User (SU). A secondary user can use the channel as long as the PU is not using it. Any SU operating on channels required by a PU, must vacate the channel or otherwise ensure no RF interference to the PU is generated. The second model describes the case where two or more users have the same right to utilize the spectrum. In this case, coexistence mechanisms need to be implemented to ensure fair sharing of resources among all users. Spectrum sharing is becoming possible because of advances in cognitive radio technology as well as more flexible spectrum regulations and incentives to share to gain access to more bandwidth. Static spectrum sharing operates on the basis of a reservation system, where a central database logs users and channel reservations. Dynamic spectrum sharing involves spectrum awareness and dynamic spectrum access (DSA). Note that DSA can also use a central database and spectrum manager, called the spectrum access system (SAS).

Spectrum sharing between communication systems and radar systems is one of the important research and development areas, especially in the 5 GHz band, but also in other bands, such as the 3.5 GHz band in the United States. When a radar system shares the spectrum with a communication system, the interference caused to the radar can impede its correct functioning. This is so because radars were not designed to coexist with communications. The authors in [2] provide an overview of some of the techniques that have been proposed for sharing the spectrum between radar and wireless communication systems.

In this paper, we present the fundamental spectrum sharing concepts and technologies. Then we provide an updated and more comprehensive survey of spectrum sharing techniques that have been developed to enable some of the wireless communication systems to coexist within the same band of radar systems.

2. References

1. Y.-C. Liang, K.-C. Chen, G. Li, and P. Mahonen, “Cognitive radio networking and communications: an overview,” Vehicular Technology, IEEE Transactions on, vol. 60, pp. 3386{3407, Sept 2011, doi: 10.1109/TVT.2011.2158673.

2. H. T. Hayvaci and B. Tavli, “Spectrum sharing in radar and wireless communication systems: A review,” 2014 International Conference on Electromagnetics in Advanced Applications (ICEAA), Palm Beach, 2014, pp. 810-813., doi: 10.1109/ICEAA.2014.6903969.