

## **Suzan Bayhan**

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### **Channel Selection and Assignment Schemes for Efficient Spectrum Sharing and Energy Efficiency in Cognitive Radio Networks**

In this thesis, we focus on distributed channel selection and centralized channel assignment in cognitive radio networks (CRN). For the former topic, we are concerned with the efficiency of spectrum sharing whereas in the latter, we also aim to improve energy efficiency of the CRN. First, we propose a non-selfish distributed channel selection scheme which improves the efficiency of spectrum sharing by mitigating the spectrum fragmentation. We also present an analytical model for our proposal using Continuous Time Markov Chains. In this thesis, we also devise various centralized channel assignment algorithms that outperform pure opportunistic schedulers in terms of energy efficiency and fairness notion without significantly trading off throughput efficiency. Initially, we consider a CRN which acquires channel occupancy information from a white space database. We develop heuristic algorithms considering transmission, idling and channel switching periods in both contiguous and fragmented spectrum. Finally, we consider a CRN in which CRs apply a listen-before-talk access approach. Different from our previous proposal, this scheduler ensures that interference caused by CRs does not exceed the tolerable limits in any of the primary user (PU) channels. In addition, it considers the differences among the PU channels in terms of probability of being idle as well as the control messaging overhead in downlink and uplink. Considering the tradeoff between the scheduling overhead and PU interference probability, we identify the frame length achieving high throughput. Simulation results show that our proposal achieves high throughput performance comparable to a throughput maximizing scheduler but it consumes lower energy than the latter.

#### **PUBLICATIONS**

##### **Journals**

1. **Suzan Bayhan** and Fatih Alagöz, "Scheduling in Centralized Cognitive Radio Networks for Energy Efficiency", *under revision*, IEEE Transactions on Vehicular Technology, July 2012.
2. **Suzan Bayhan**, Salim Eryigit, Fatih Alagoz and Tuna Tugcu, Low Complexity Uplink Schedulers for Energy-Efficient Cognitive Radio Networks, *submitted to IEEE Communications Letters*, May 2012.
3. **Suzan Bayhan** and Fatih Alagöz, "Distributed Channel Selection in CRAHNs: A Non-Selfish Scheme Mitigating the Effect of Spectrum Fragmentation", Ad Hoc Networks (Elsevier), SI on CRAHNs, Volume 10, Issue 5, July 2012, Pages 774–788.
4. **Suzan Bayhan** and Fatih Alagöz, "A Markovian Approach for best-fit channel selection in cognitive radio networks", Ad Hoc Networks (Elsevier), 2011.
5. Gürkan Gür, **Suzan Bayhan**, Fatih Alagöz, "Cognitive Femtocell Networks: An Overlay Architecture for Localized Dynamic Spectrum Access," IEEE Wireless Communications Magazine - SI on "Dynamic Spectrum Management", August 2010.

##### **Book Chapter**

1. **Suzan Bayhan**, Gürkan Gür, and Fatih Alagöz, Cognitive Capabilities for Femtocell Networks: Cognitive Femtocells, in Cognitive Radio and its Applications for Next Generation Cellular and Wireless Networks, Lecture Notes in Electrical Engineering, Vol. 116, Hrishikesh Venkataraman and Gabriel-Miro Muntean (Eds.), 2012.

### **International Conferences/Workshops**

1. **Suzan Bayhan** and Fatih Alagöz, Energy Efficiency of Scheduling Schemes in Cognitive Radio Networks, Wireless Information Theory Summer School, July 27-29, 2011, University of Oulu, Finland. *[one of the three best posters]*.
2. **Suzan Bayhan** and Fatih Alagöz, A Non-Selfish and Distributed Channel Selection Scheme in CRAHNS, The 13-th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MsWiM'10), October 17-21, 2010, Bodrum, Turkey.
3. **Suzan Bayhan** MAC layer design in cognitive radio networks, PhD Forum, 11th IEEE WoWMoM 2010, June 13-17, 2010, Montreal, Canada.

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