# On-Textile Coupled Magnetic Resonators for Wireless Power Harvesting Applications

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Various methods of wireless power transfer have been considered in the past few years for numerous applications. Among them, the radiative and inductive approaches have been studied the most. The radiative method utilizes antennas for power reception and transmission at far-field distances. The inductive method uses coils to realize power transfer through magnetic coupling, making it a near-field approach. The latter is the method of choice for close proximity applications, and works well with sedentary users. It can be integrated into clothing, couches, curtains, mattresses, car seats, backpacks, and wheelchairs to cater patients who are dependent on medical devices like body-worn IoT devices, implanted devices, and biosensors. Researchers have been investigating coupled magnetic resonators that demonstrated power efficiency of about 90% for short distances at low frequencies ranging in the megahertz. But although this technique is widely used in wearable applications, various challenges such as flexibility, robustness, conformity, and the effective integration into textiles are yet to be tackled.

In this paper, we propose a cost-efficient, scalable, and fully flexible inductive power transfer system consisting of coils made of conductive embroidery onto fabric. The transmission coefficient of these systems were measured at different distances separating the transmitting and the receiving coils. The collected measurements revealed that at a distance of 10mm, more than 60% of the RF power was transferred at 2 GHz, and at 20mm distance more than 50% of the RF power was transmitted.

For demonstration, the developed prototype was used to power a textile-based rectifying circuit using an input power of 19 dBm at 2 GHz. The DC voltage at the harvester was about 1.5 V at 5 mm of separation distance, 1.43 V at 10 mm, and 1.3V at 15 mm. These voltage levels were used to power an LCD temperature sensor. Measurements were also collected at 20.5 cm of separation between the coils and the measured DC voltage at a minimum of 0.163 V. The flexibility of the prototyped structure and its unobtrusive integration into garments makes it highly attractive to wearable applications. At the conference, we will present the analysis, simulations and measurements of the proposed inductive harvester, including its power transfer efficiency related to the design parameters and the employed embroidery technique.