

Reconfigurable Electronics
AFOSR Workshop (17-19 May 2016), Arlington, VA
Prospectus

We view this workshop is having the following purposes:

- To identify the game changing potential of reconfigurability to military systems (and society in general). It is important to understand the importance of this pursuit and where the current leading/bleeding edge activities in the associated research fields currently are;
- To identify opportunities for unifying our vision and collaborating, and to understand where we can have the most impact

In reconfigurable electronics, we seek to discover and better understand foundational mechanisms of reconfigurability expressed in changes of material properties and geometries and how these manifest in the performance of electronic devices, circuits, and systems. In a nutshell, reconfigurability can dramatically enhance the flexibility of system functions and applications, improve robustness/resilience, allow systems to be built more rapidly, and in many cases improve affordability through inventory collapse. Much of the current state-of-the-art in reconfigurable systems is predominately based on a single reconfigurable mechanism, namely the management of many point charge configurations within a complex digital system, such as a computer or a field programmable gate array. Even in this narrow context, reconfigurability has launched entire fields of research in these areas, augmented more recently by the advent of software defined networking and software definable radio, which largely owe their existence to the ability to reconfigure charge patterns.

As impressive as this is, we have only begun to scratch the surface. We seek to expand the possibilities of reconfigurable electronics by developing a better understanding of other possible fundamental mechanisms, ultimately with the expectation that we can create even more provocative instances of reconfigurable systems that can take advantage of them. We expect the ability to pervasively morph key elements of systems by embedding reconfigurability will lead to the advent of systems that are far more flexible in the field, as well as more robust and economical.

These new methods will span technological applications into *universally configurable radio frequency appliances (far beyond the present conceptualizations implementation software radio), software defined networks, programmable matter, autonomously reconfigurable wiring systems, evolving computational and physical systems, heat transport shaping, fundamental system building block construction, materials design, recyclable hardware, and evolutionary bio-mimicking machines.*

Analog systems like microwave electronics and meta-materials do not currently have metrics to construct state expressiveness or equivalence like electronic hardware systems, i.e. FPGA's with Boolean Logic and computer programs with Turing Machines.

In this workshop, we seek to engage and develop a community of interest, explore the potential research frontier, identify ways to collaborate a garner support for the pursuit, and develop roadmaps and follow-on courses of action.