**Distributed Coupling Linacs from Room to Cryogenic Temperature**

In this talk, we will present the theory, simulations, and experimental results for new concepts being explored at SLAC for high-gradient RF accelerators, namely the distributed coupling accelerator technology. We utilize a novel power-feeding technique that feeds every accelerating cell independently using a distributed feeding network. This eliminates the need for excessively large coupling holes between adjacent cells, which gives considerable optimization flexibility for the accelerator geometry and enhances the accelerating parameters.

We will also present our experimental investigation of the operation of the distributed coupling linac at cryogenic temperatures. Low-temperature operation increases surface hardness resulting in a large reduction in breakdown rates compared to room-temperature operation. Also, reducing the operating temperature of these normal conducting linacs reduces their surface resistance. This reduction increases the shunt impedance and intrinsic quality factor of the accelerating cavities leading to increased RF-to-beam-efficiency.

Combining the design flexibility and enhanced accelerating parameters of the distributed coupling technology with the enhanced material properties at cryogenic temperatures opens the door for many advanced applications, including future discovery machines. These concepts are possible to apply to superconducting linacs as well. We will present our initial attempts to build and test a distributed coupling superconducting linear accelerator.

**Bio**

**Mamdouh Nasr** is a PhD Candidate in the Department of Electrical Engineering at Stanford University. He is pursuing his PhD research at SLAC National Accelerator Laboratory under the supervision of Professor Sami Tantawi. Recently, Mamdouh’s research efforts have focused on the development and experimental verification of the distributed coupling linac for single and multi-frequency operation, normal conducting accelerators at cryogenic temperatures, and new design concepts for superconducting linacs.

Mamdouh received his bachelor's and master’s degrees in Electronics and Communications Engineering from Cairo University. He is a recipient of the Siemann Graduate Fellowship in Physics at Stanford University for outstanding graduate students doing accelerator research. He is also a recipient of the Linac 2020 Student Prize. His research interests include high power devices, quantum computing, and biomedical applications.