Design of systems for microwave breast cancer detection
project title
Technical University of Denmark
host institution

Project description:

Worldwide, more than a million women are diagnosed with breast cancer every year. It is the most common cancer and the second leading cause of cancer death in women today. Research over the last years indicates that microwave imaging might be an accurate method for breast cancer detection. The method is based on measurement of the complex transmission coefficient in several directions through the object to be imaged (the breast). This data is then used to reconstruct an image. This image should be used to detect cancer tissue. However, presently no commercial 3-D imaging system exist, so experiences with this type of images are limited. The long-term goal of the breast cancer project at DTU Elektro is to develop a system suitable for clinical test.

The microwave imaging system to be developed in this project employs a multi-element antenna array connected to a Vector Network Analyser (VNA) through a multichannel switching network, enabling multiport coherent measurements.

The project focuses on developing the hardware for gathering the needed data. The main components of the system are:

- 2-port network analyzer;
- Switching network;
- Antenna system;
- Control electronics.

The heart of the system will be the VNA, which is used to do the actual measurement. Since most VNAs only provide two ports, a switching network should be created to extend the two ports. This will make it possible to select one of the multiple antennas for transmission and another for receive as illustrated in Fig. 1.

The antenna system is already developed and is suitable to generate data for a 3D image.

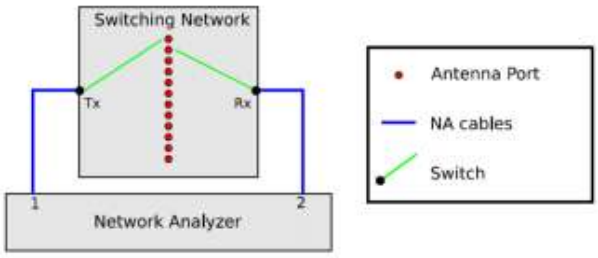

Fig.1. The switching network makes it possible to select one antenna for transmit and another for receive.

The goal of the project is to design fabricate and characterize the multiport switching network, which would provide a wide operating frequency range (from 0.5 GHz to 3+ GHz), maintain a high level of channel-to-channel isolation (over 100 dB) and high switching speed (in order of seconds). To achieve a high sensitivity it would probably be necessary to include a broad-band (of the-shelf) low-noise amplifier in each receive channel.

The project also includes an implementation of the computer control and data acquisition.