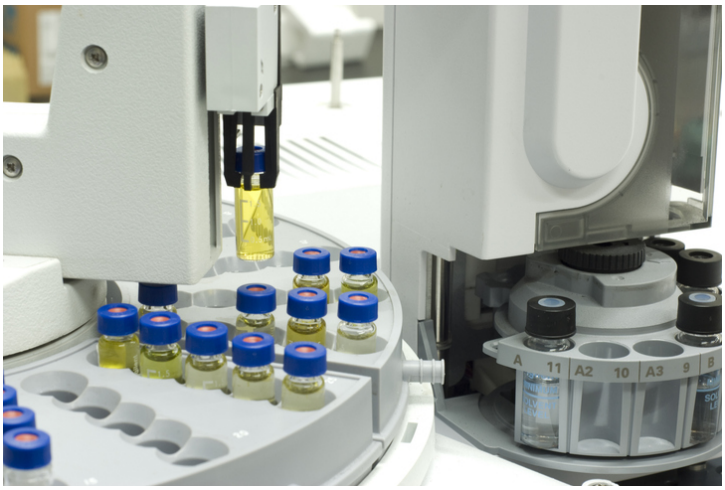
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Multi-Resonant Circuit for Quadrapole Mass Spectrometry

TECHNOLOGY NUMBER: 4867



Technology ID
4867

Category
Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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OVERVIEW

Multi-frequency circuit enhances mass spectrometry and ion trap systems' performance

- Improves resolution and efficiency using multi-resonant tank circuits
- Planetary missions, atmospheric analysis, and complex molecular studies

BACKGROUND

Mass spectrometry, particularly quadrupole mass spectrometry (QMS), has been a fundamental tool in analyzing gas compositions and isotopic ratios since its inception by Paul and Steinwedel in 1953. QMS instruments have played a crucial role in almost every planetary mission, providing pivotal data on atmospheric physics and chemistry. Traditional QMS systems, while effective, face challenges in achieving high mass resolutions ($M/\Delta M > 150$), especially in space missions where power and mass constraints are significant. Higher resolutions are necessary for analyzing complex molecules, crucial for advancing modern science topics, such as investigating the origins of life.

INNOVATION

The University of Michigan researchers have developed a novel circuit with multi-frequency resonance, significantly improving QMS and ion trap systems by enabling auxiliary excitation and amplitude modulation far from the RF frequency. This innovation leverages a network of capacitors and inductors, which are intricately tuned to desired frequency poles and load capacitances. The result is a multi-resonant tank circuit that offers more robust system operation and increased power efficiency. Additionally, the FPGA-based voltage control system enhances precision and performance. Real-world applications span planetary exploration, atmospheric analysis, and complex molecular research, utilizing the improved resolution and efficiency of QMS instruments.

ADDITIONAL INFORMATION

INTELLECTUAL PROPERTY:

US8487249 "Auxiliary frequency parametric excitation of quadrupole mass spectrometers"