Dual-harmonic Resonant Power Supply

Cezary Jach
BD/EE Support

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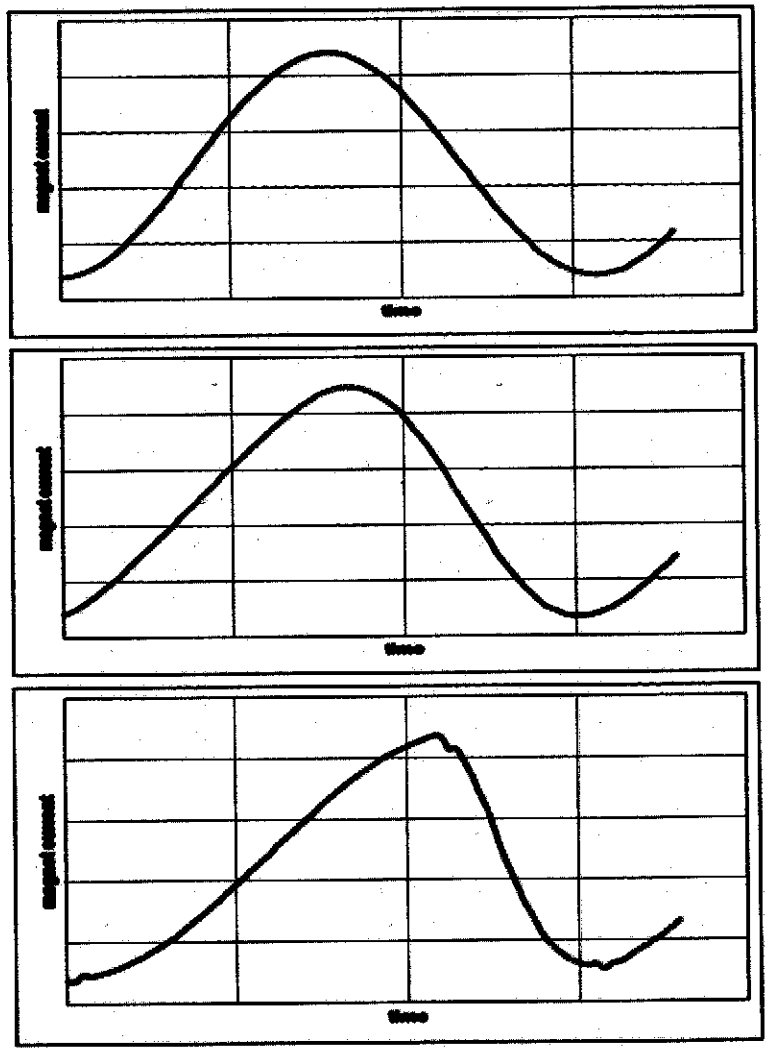
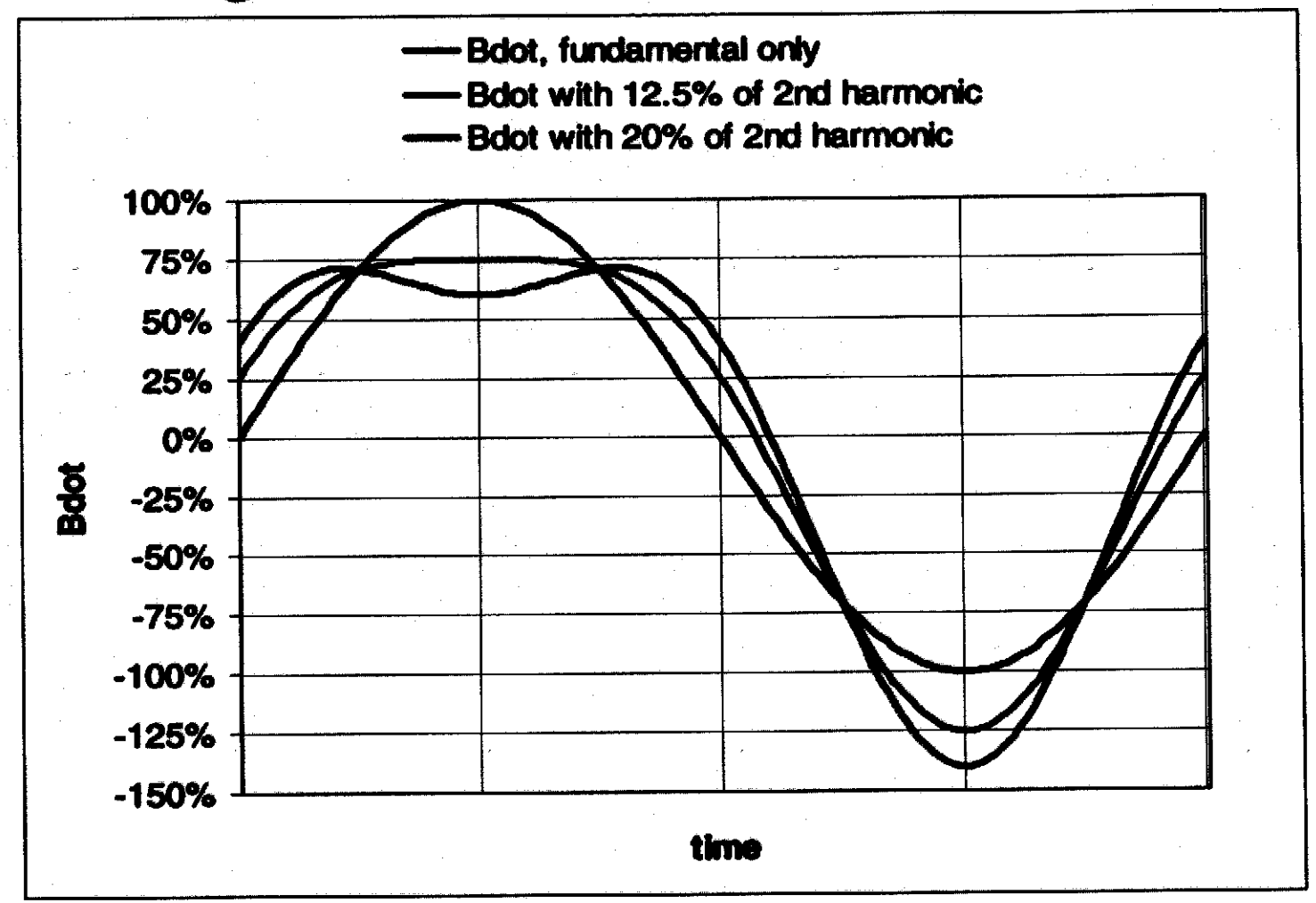
Resonant Power Supply Systems

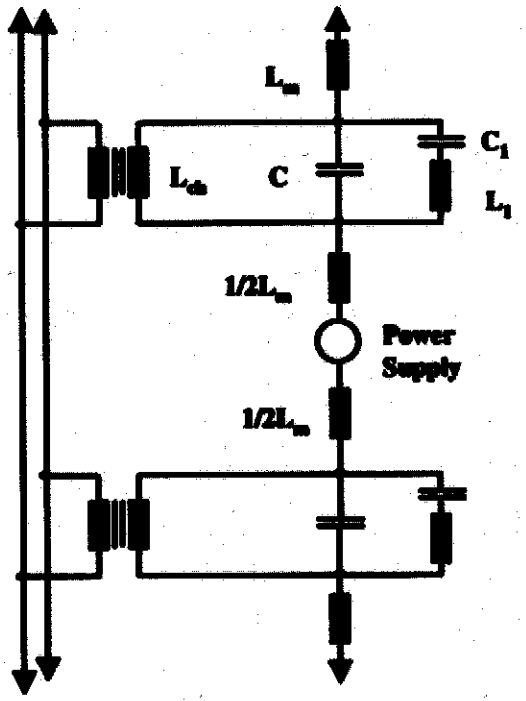
- **Single frequency. Current is in the form of biased sinusoid**
- **Dual frequency. Current is in the form of 15 Hz biased sinusoid with superimposed 30 Hz component- chosen design**
- **Switched. Current is in the form of biased 15 Hz sinusoid when rising, and 30 Hz when falling**



Adding 2nd Harmonic to Magnet Current

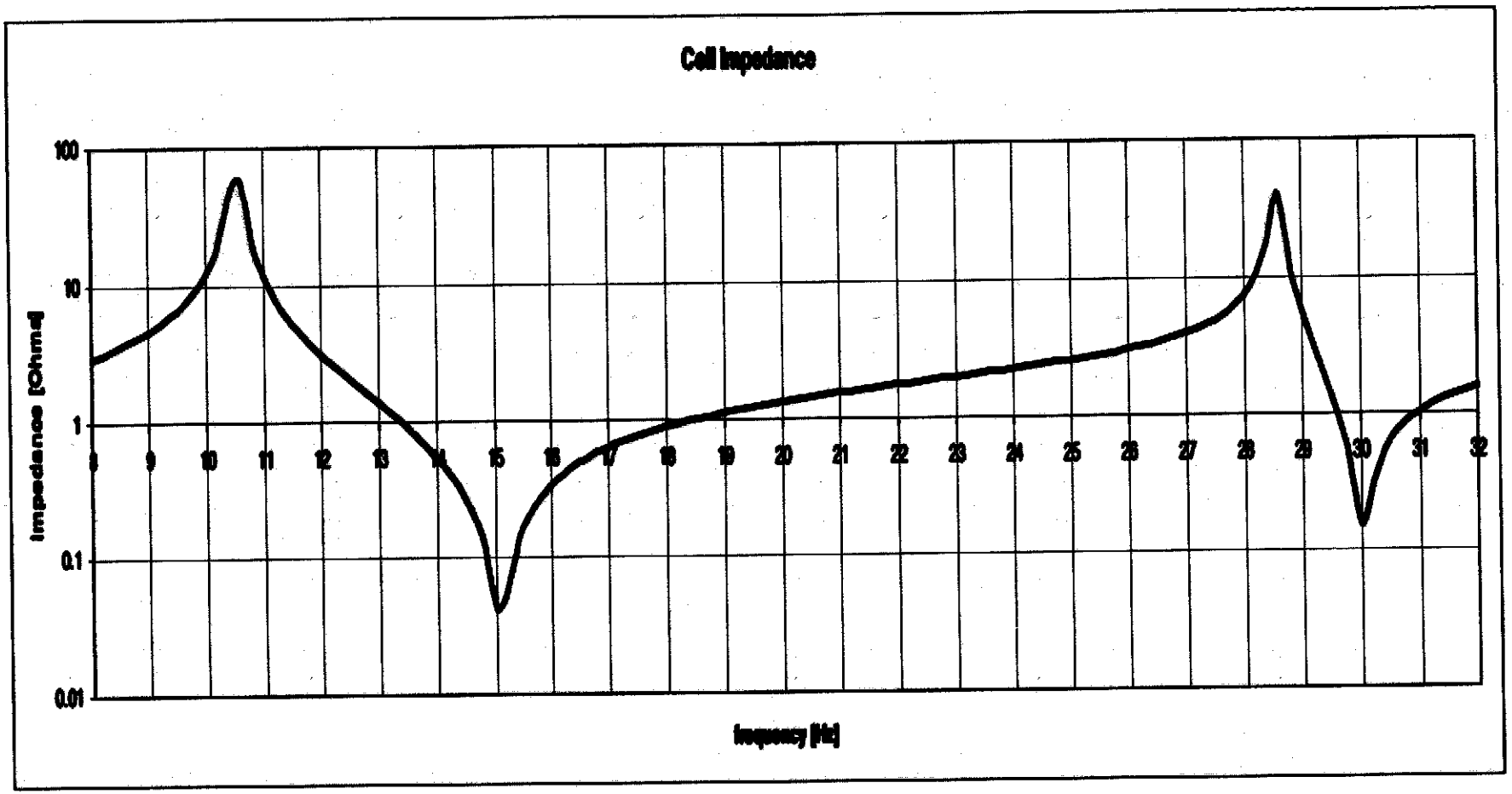


Dipole/Quadrupole Power Supply Diagram

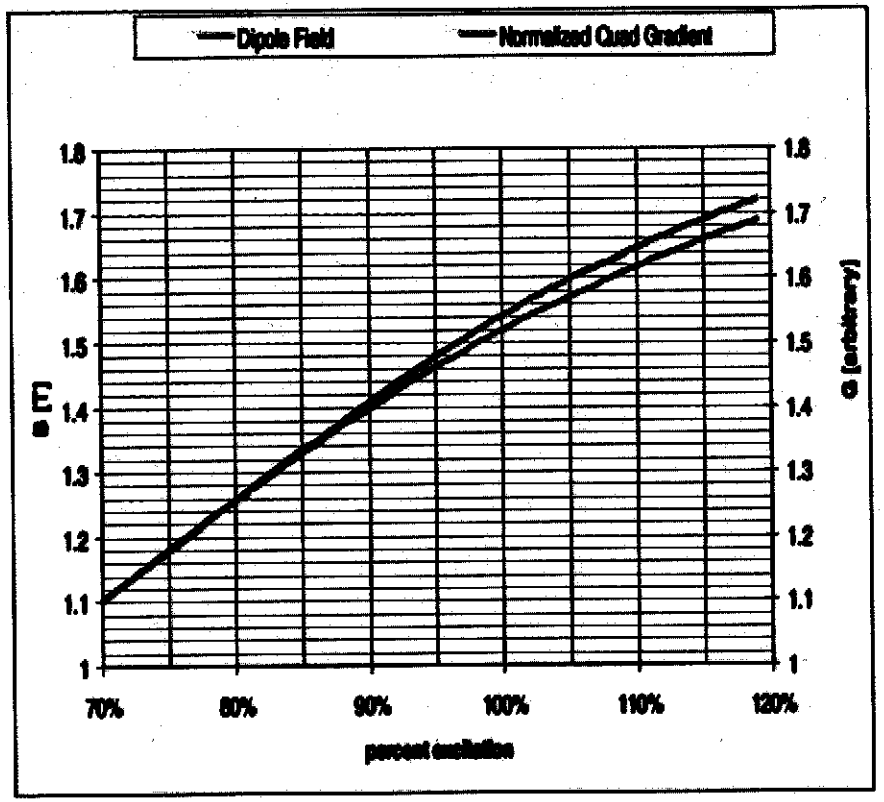


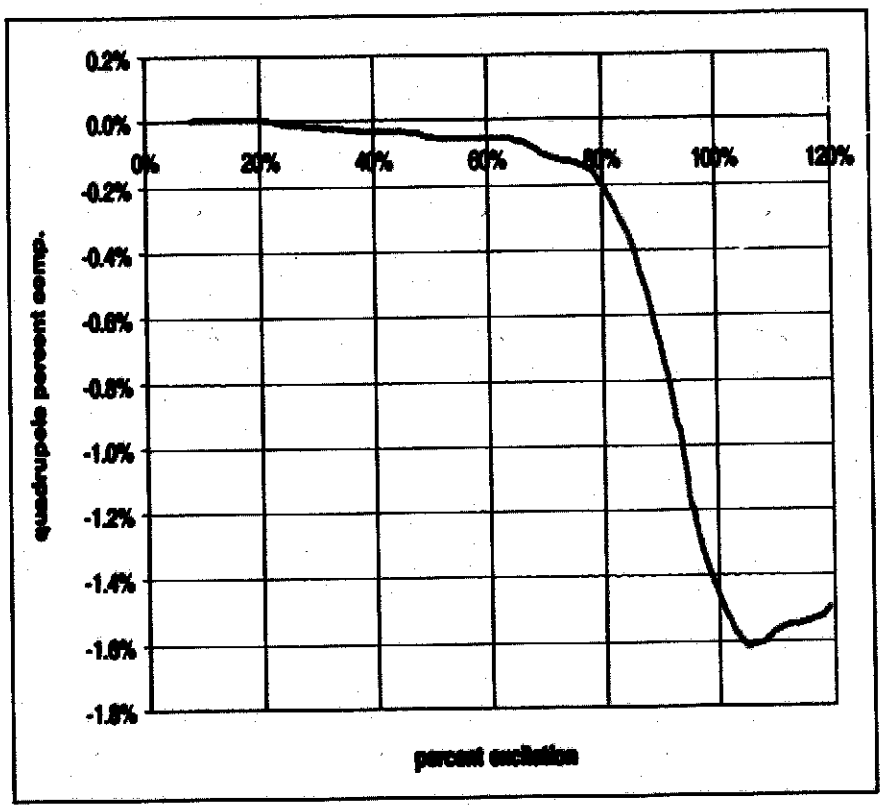
$$I(t) = I_{dc} - I_{ac}\cos(2\pi 15t) + 0.125 I_{ac}\sin(2\pi 30t)$$

Resonant Cell Frequency Response



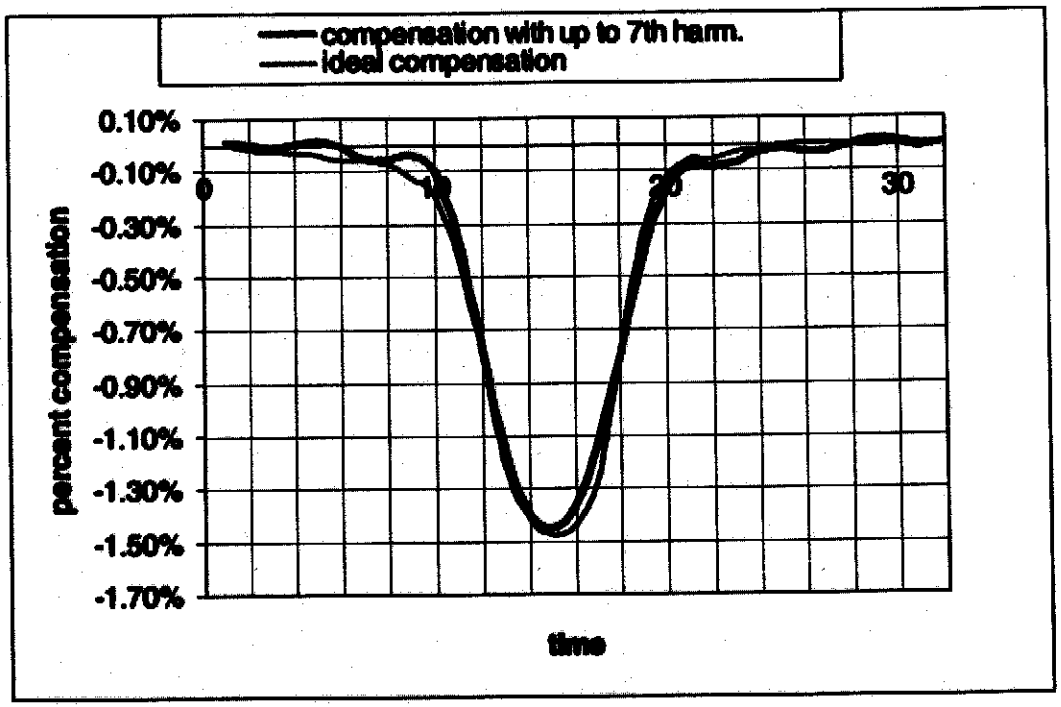
Quadrupole Tracking



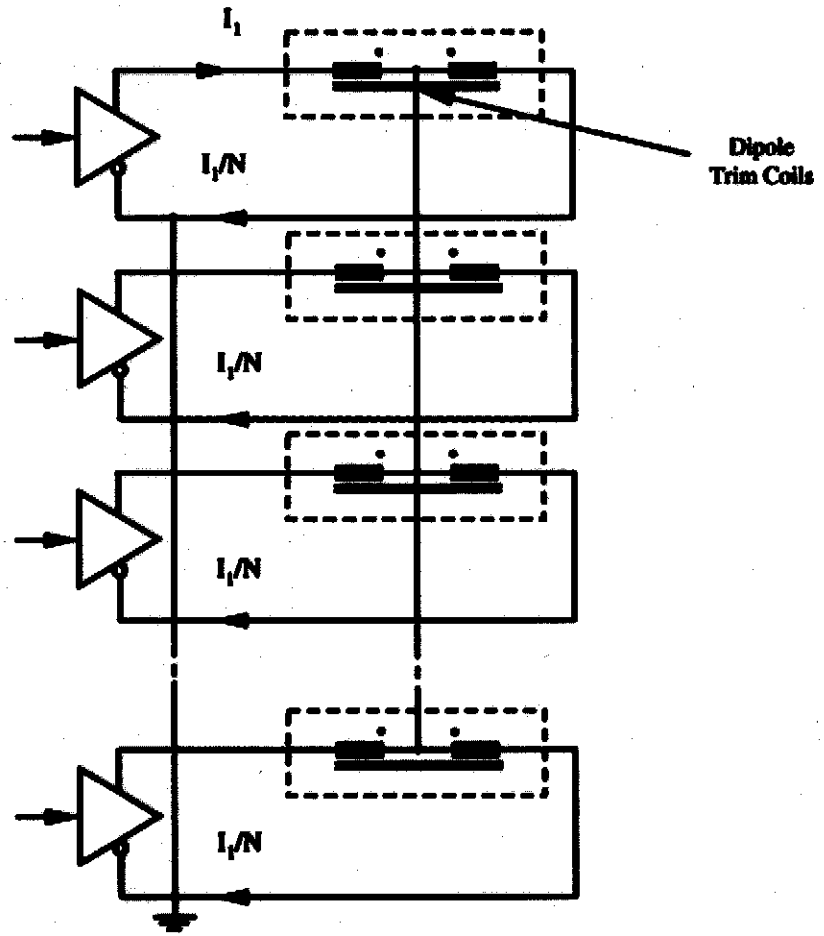


Quadrupole Tracking

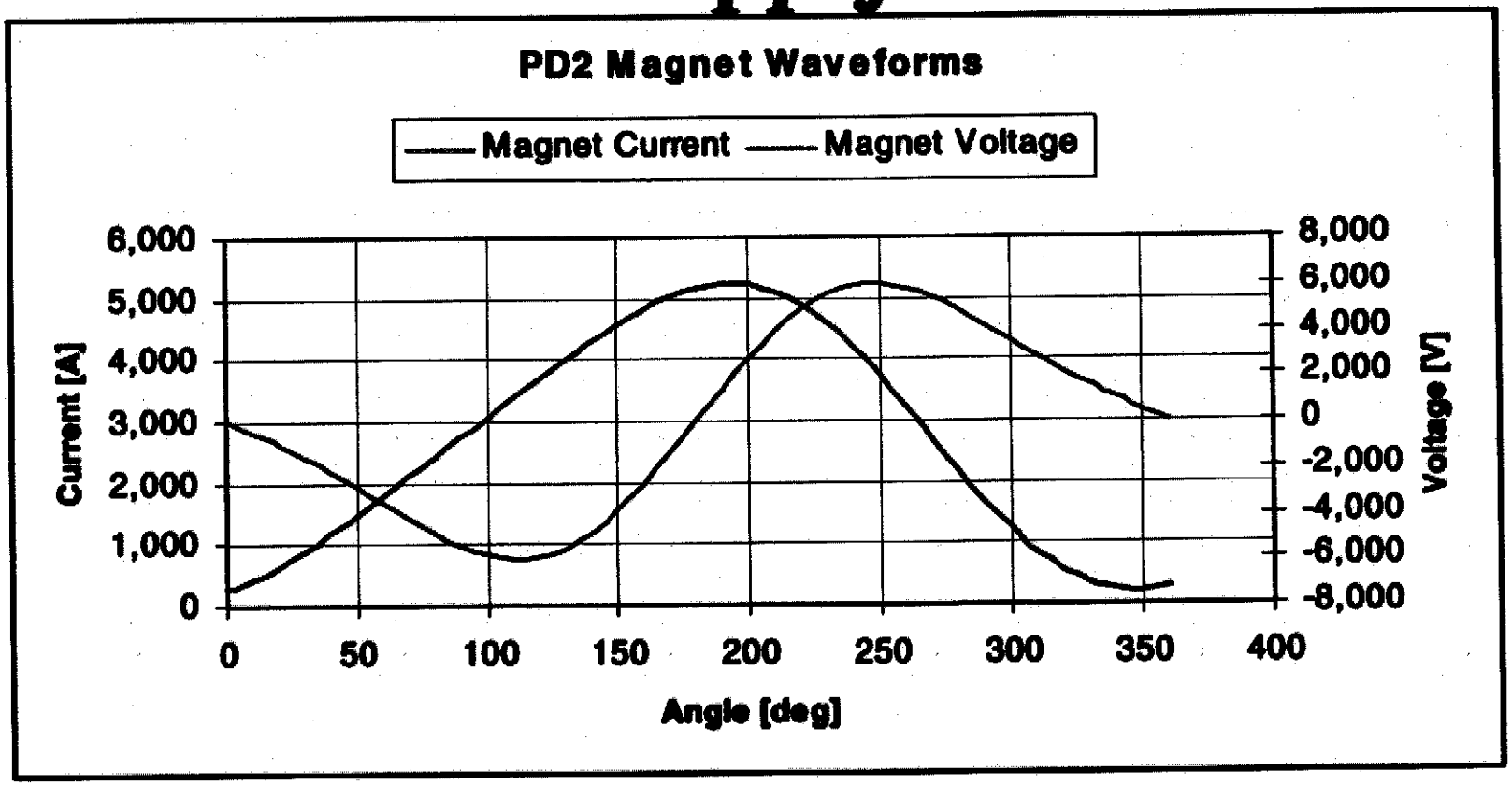
- $|\Delta|_{max} \leq 0.01\%$ if compensation current includes up to 7th harmonic



Dipole Horizontal Correction System



Proton Driver 2 Study – Dipole/Quadrupole Power Supply



Proton Driver 2 Study – Dipole/Quadrupole Power Supply

• Magnet current:	
• peak	5,170 A
• dc	2,730 A
• ac, 15 Hz	2,440 A
• ac, 30 Hz	310 A
• Magnet voltage to ground, peak	3,100 A
• Number of resonant cells	22
• Power supply voltage, peak	±1,600 V
• Power supply current, peak	5,200 A
• Number of power supplies	4

Required R&D

- Involvement in a high voltage magnet (dipole and quadrupole) design and testing program
- A complete resonant cell prototype. It will include dipole and quadrupole prototypes, chokes, capacitors, power supply, regulation and control systems
- Quadrupole tracking system development. It will include prototype of resonant cell, bucking choke, tracking power supply, regulation, and control systems
- Main dipole/quadrupole power supplies development. Power supply will employ the newest IGBT technology