

GREGORY J. DURMAN

PhD (Electrical Engineering) • FIMarEST • CEng • CMarEng

Honorary Industry Associate Professor, University of Technology Sydney

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RESEARCH PROFILE

RF engineer and electromagnetics scientist with 20+ years of MRI coil design, NMR resonator development, and antenna theory. Principal designer for the GE 1.5T HDX 16-channel phased array and designer of approximately 30 NMR resonators including a 900 MHz birdcage coil for a 21T system (National High Field Laboratory). Identified fundamental limitations in classical birdcage coil theory during work at the University of Queensland and GE Research; developed the theoretical correction and software tools to implement it. Recent patent filings correct the theoretical basis of coupled resonator design and introduce a novel resonant LC approach to clinical MRI that eliminates the superconducting magnet entirely. Active publication programme: 60+ papers and 3 books in 2024-2025. Seeking research collaboration, consulting, or senior scientific roles in MRI RF systems.

RECENT PATENT FILINGS (APRIL 2026)

US Provisional Application 64/040,031 — LC/LCR Network Correction of Coupled Resonator Systems for Ideal Current Distribution with Contactless Iterative Optimization. Filed 04/15/2026.

- Establishes that capacitive elements alone are insufficient to ensure sinusoidal current distribution in birdcage structures whose electrical length does not naturally support it. LC or LCR networks at each end ring break provide the additional degrees of freedom required. Includes contactless iterative tuning via PWM laser, fibre optic, or wireless telemetry with leg current pickup feedback to a genetic algorithm optimizer. Generalises to all coupled resonator networks per Dishal (IRE, 1949).

US Provisional Application 64/040,049 — Magnetic Resonance Imaging Using Resonant LC Field Generation with Pulse Sequence Synchronisation to Field Peaks. Filed 04/15/2026.

- Primary B0 field generated by a resonant LC circuit at clinical field strength (>0.5T). RF pulse sequences synchronised to field peaks where dB/dt = 0, satisfying biological safety constraints. Eliminates superconducting magnet, liquid helium infrastructure, quench risk, and persistent fringe field missile hazard. Enables clinical MRI deployment in remote hospitals, mobile units, maritime, and resource-limited environments. Distinguishes from all FFC-MRI prior art which operates below 0.5T.

MRI AND NMR EXPERIENCE

Advanced RF Engineer — MRI Coil Design | *GE Healthcare (USA Instruments), Aurora OH* 2006 – 2007

- Principal designer, 16-channel VHF phased array for GE 1.5T Signa HDX: full NPI lifecycle from prototype to manufacturing evaluation.
- Characterised SNR, noise figure, and channel isolation across array elements; regular travel to GE Milwaukee for coil performance testing.
- Worked at GE Research (Niskayuna NY) identifying future MRI coil technology directions.
- Supported FDA investigation: prepared FMEA risk assessments, CAPA reports, and 510k submissions.
- Identified fundamental flaws in classical birdcage design theory during this period — the basis of the 2026 patent filing.

RF Design Engineer — NMR Resonators | *University of Queensland / Spin Systems / M2M Imaging* 2004 – 2006

- Designed approximately 30 VHF/UHF NMR resonators for research and commercial NMR instruments.

- Designed one of the world's highest-frequency birdcage resonators: 900 MHz for a 21T NMR system at the National High Field Laboratory, Florida. Results published in Journal of Magnetic Resonance Vol. 177 (2005).
- Developed original numerical simulation code for current distributions in multi-element resonators using analytical techniques.
- Identified errors in birdcage theory that cannot be resolved with capacitive elements alone — the theoretical foundation corrected in the 2026 patent.

Honorary Industry Associate Professor | *University of Technology Sydney (based San Diego)*
2023 – Present

- MRI research engagement with GE at Stanford; microwave AI and electromagnetics research.
- Active publication programme: 60+ papers and 3 books published 2024–2025.

MRI RF COIL SOFTWARE SUITE (DURNAN.ORG)

- **3D birdcage coil designer in JavaFX. Corrects classical current distribution theory. Outputs CNC cut files. Available at durnan.org. NOT FOR COMMERCIAL USE — contact author for licensing.**Birdcage Builder —
- **FDM-based birdcage design tool. Available at durnan.org/birdcage-fdm-workbench.**FDM Birdcage Workbench —
- **Full wave birdcage solver including plastic loading effects. In final development.**Full Wave Iterative Tool —
- **Interdigital capacitor design tool for MRI coil applications. In cleanup stage.**Interdigital Designer —
- All tools available for evaluation at durnan.org. Commercial licensing available.

SELECTED PUBLICATIONS RELEVANT TO MRI / COUPLED SYSTEMS

1. Durnan G.J., “Mutual coupling of co-located loops and coils” — Extension to circuit theory solution by introduction of additional reactive elements. IEEE Antennas and Propagation Society Conference, Orlando FL, 2013. DOI: 10.1109/APS.2013.6711284.
2. Durnan G.J., “Design of 900 MHz birdcage resonator for 21T NMR” — Journal of Magnetic Resonance, Vol. 177, 2005. One of the world's highest frequency birdcage coils at time of publication.
3. Durnan G.J., “An optimization method for maximizing the mode content in Microwave Cavities” — IET Electronics Letters, January 2022.
4. 60+ additional papers and 3 books published 2024–2025. Full list at durnan.org and ResearchGate.

EDUCATION

PhD, Electrical Engineering (Antenna Science) Griffith University / Yokohama National University
1998–2005

Dissertation: Parasitic feed elements for reflector antennas. National APAR Recipient; JSPS Full Scholarship. Physical Optics simulation engine written as part of PhD work.

BTech First Class Honours, Microelectronics Griffith University
1997–1998

Dissertation: Design, construction and testing of VHF Antarctic ice depth radar.

MBA Royal Holloway, University of London
2007–2011

PROFESSIONAL MEMBERSHIPS

- Fellow, Institute of Marine Engineering, Science and Technology (FIMarEST)
- Chartered Engineer (CEng), Engineering Council UK
- Chartered Marine Engineer (CMarEng)
- Senior Member, IEEE
- Member, IEEE APS Standards Committee (Ground Wave Propagation)
- Fmr Member, ISMRM

ADDITIONAL PATENTS

- US10602573B2 — RF Excitation Signal Parameters in Solid-State Heating Apparatus
- US20190394841A1 — Variable TDM of Electric Field Modes for Zonal Microwave Cooking
- US10355362B2 — Integrated Antenna Power Amplifier
- EP3264459A1 — Shielded Package with Integrated Antenna
- US20140247194A1 — GNSS Antennas (Hemisphere GPS)
- US20130142295A1 — GNSS Signal Interference Mitigation System

Full publication list, software portfolio, and references available at durnan.org