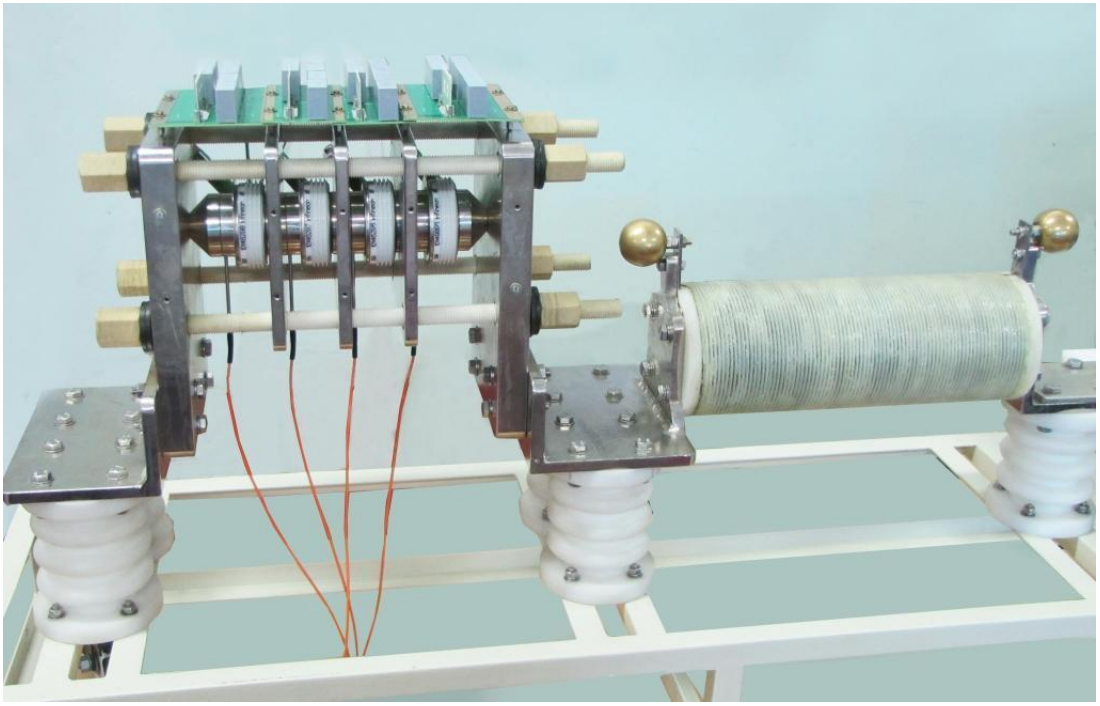
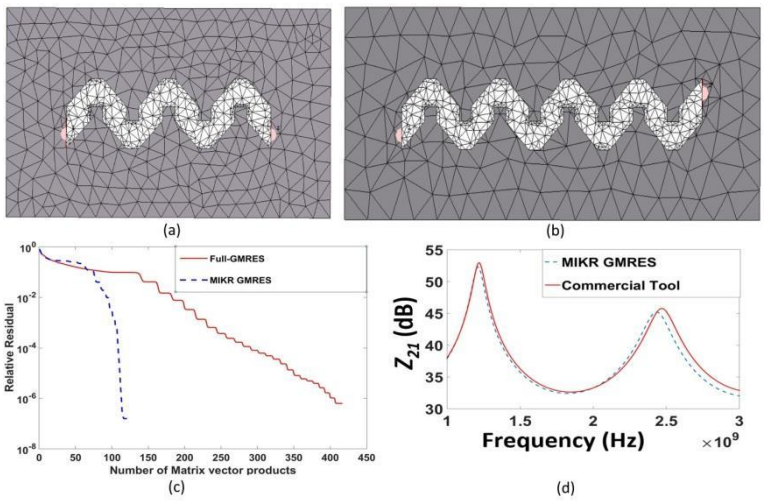
1. **Vinod John (EE)**



Microwave tubes (MWT) require protection to prevent system failure and economic loss. A fast-acting crowbar can be used for this. The solid-state crowbar (SSC), shown in the picture, has been designed and developed at IISc-Bangalore and CDAC-Thiruvananthapuram. It is India's first 10 MegaWatt pulse-power SSC for MWT protection. The SSC is currently being used at the Institute for Plasma Research, Ahmedabad.

Reference: TG Subhash Joshi, **V John** (2017) Performance Comparison of ETT- and LTT-Based Pulse Power Crowbar Switch*. IEEE Transactions on Plasma Science*, 45(11): 2994-3000 (doi: 10.1109/TPS.2017.2759668)

2. Dipanjan Gope (ECE)



Today's 3D full-wave electromagnetic solvers treat each model independently regardless of any similarity with a previously solved model. In this work, a Mesh-Interpolated Krylov Recycling (MIKR) technique is proposed to reuse the Krylov subspace of the base design (Figure a) to expedite the 3D full-wave electromagnetic solution of a design variant (Figure b). Numerical results demonstrate up to 4x speed-up (Figure c) over existing commercial solution with uncompromised accuracy (Figure d).

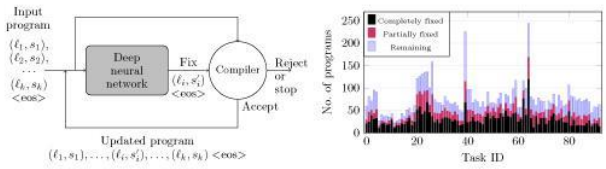
Reference: G Chatterjee, A Das, SV Reddy and **D Gope** (2017) Mesh Interpolated Krylov Recycling Method to expedite 3D Full-Wave MoM Solution for Design Variants. *IEEE Transactions on Microwave Theory and Techniques*, 65 (9): 3159-3171.

3. **Gurunath Gurrala (EE)**

As part of E-Sense project for home automation, a small form factor device has been developed. It converts the existing manual electrical switch to a remotely controllable switch through Wi-Fi. Simultaneous remote and manual operation is possible. It also has an inbuilt fail-safe mechanism to protect the devices in case of remote control failure. Provisional Patent has been filed for the device and the and the possibility of setting up a start-up is being explored.

Reference: A Joglekar, **G Gurrala** and A Lele (2017) Provisional Patent: 201741016231, *Controlling Electrical Devices*, Indian Institute Of Science.

4. Aditya Kanade (CSA)



DeepFix is the first end-to-end deep learning based system to automatically correct common programming errors. It can help provide automated feedback in massive open online courses (MOOCs). (Left) The iterative procedure of DeepFix to fix multiple programming errors. (Right) The performance of DeepFix in fixing erroneous programs written by students during 93 different programming assignments in an introductory programming course.

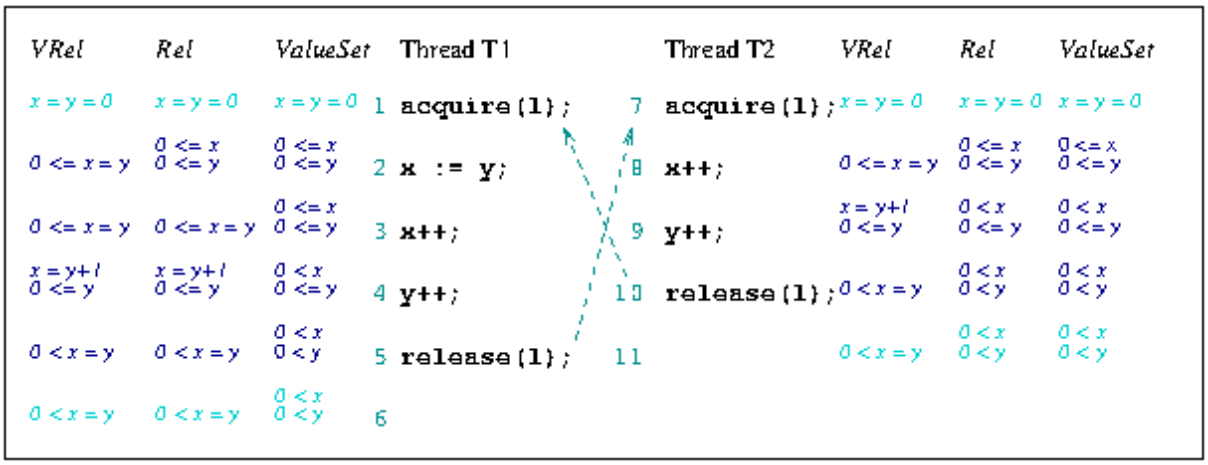
Reference: R Gupta, S Pal, **A Kanade**, SK Shevade (2017) DeepFix: Fixing Common C Language Errors by Deep Learning. *Proceedings of the Thirty-First AAAI Conference on Artificial Intelligence*. 1345-1351.

5. TV Prabhakar (DESE)

A hybrid ultra-low power embedded system has been prototyped for monitoring latches/hatches in an aeroplane. The system, with a guaranteed life of 10 years, can be configured to function in modes such as SECURITY CONFIG, ARM, DISARM and STATUS and is available via an android app. This is an energy harvesting system accompanied by a 250mAH coin cell battery.

Reference: TV Prabhakar, MB Madhuri, K Anup K and S Sudhir. Tamper Monitoring IoT Network, Internal report DESE - 2018.

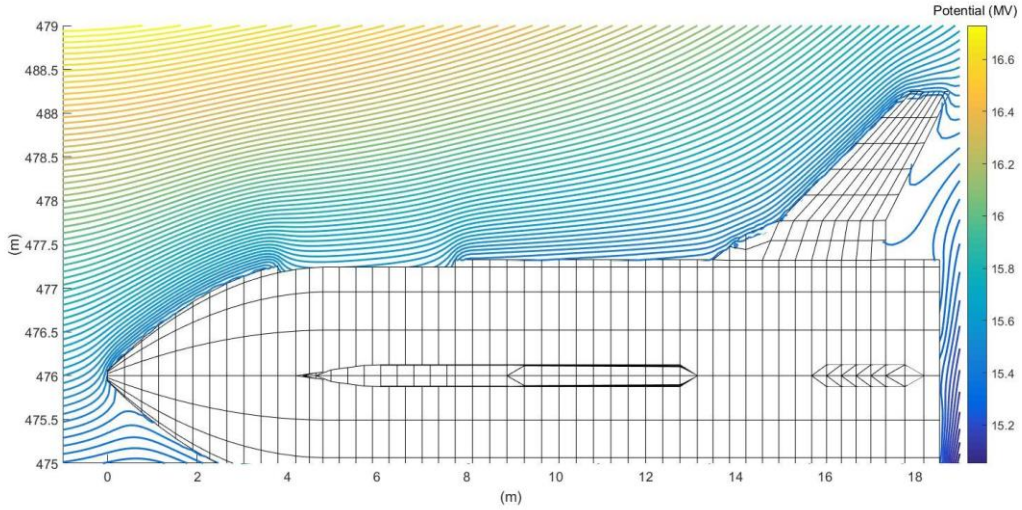
6. **Deepak D'Souza (CSA)**



Static analysis of concurrent programs is challenging due to the many possible interleavings of program threads. This work proposes a way of efficiently analyzing the class of data-race-free programs, based on a thread-local semantics. The figure shows the control-flow structure of a program with two threads, and the facts inferred about program variables by three different analyses.

Reference: S Mukherjee, O Padon, S Shoham, **D D'Souza** and N Rinetzky (2017) A Thread-Local Semantics and Efficient Sequential Abstractions for Race-Free Programs. Proc. *Static Analysis Symposium 2017*.

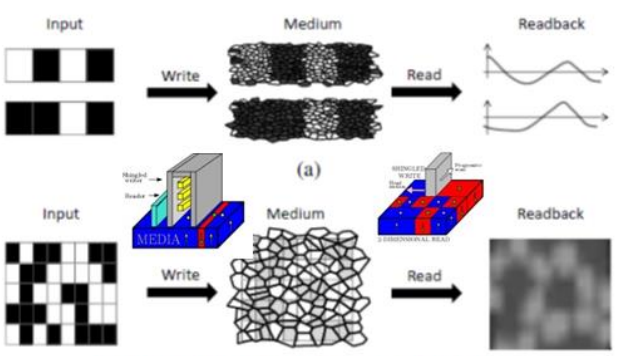
7. Udaya Kumar (EE)



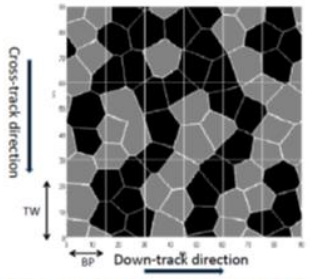
A simulation of the electric potential around a standard dynamic model aircraft flying at 500 m altitude due to an approaching lightning leader.

Reference: U Kumar and V Coooray (2017) Limitations of RSM in Zoning of Aircrafts, *10th Asia-Pacific International Lightning Conference 2017, Thailand*.

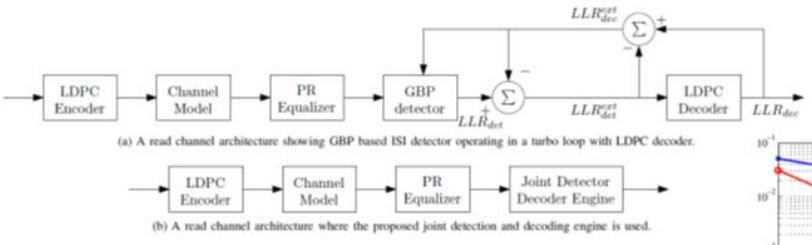
8. Shayan Garani Srinivasa (DESE)



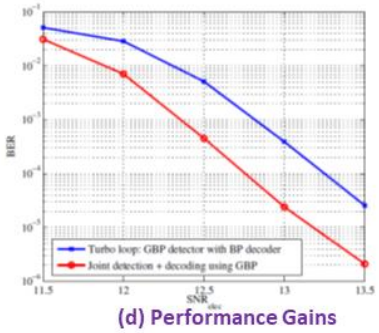
(a) Reading/writing on a magnetic medium



(b) Magnetic domains in nm scale



(c) Two novel read channel architectures: Turbo loop over a 2D detector and 2D decoder and a novel joint detection decoder engine

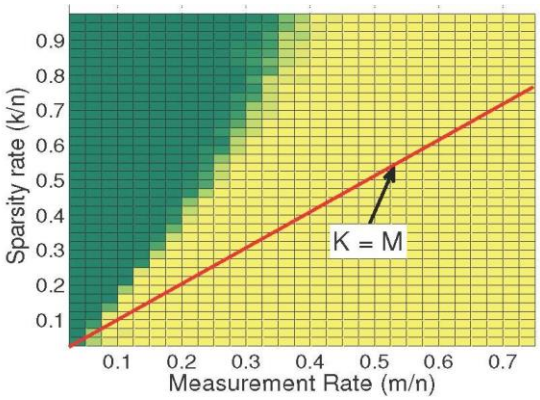


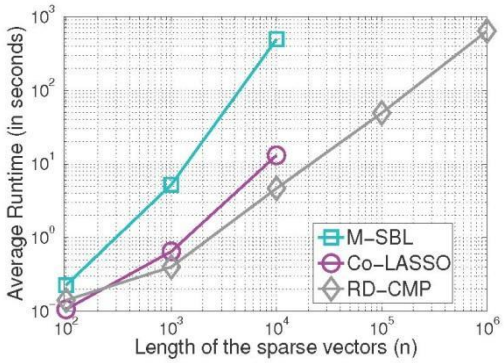
(d) Performance Gains

Two-dimensional magnetic recording is an emerging technology to boost areal densities in magnetic memories driven purely from a systems framework using powerful 2D signal processing and coding methods and can add additive areal density (AD) gains over bit patterned media (BPM) and energy assisted magnetic recording (EAMR). We have conceived a fully native 2D channel from first principles attuned to TDMR technology. This includes the 2D detection decoding engines within a turbo loop, as well as, a complex joint 2D detection decoder algorithm, which is the best channels architecture. Using these channels technology, areal densities can be more than doubled.

Reference: CK Matcha, S Roy, M Bahrami, B Vasic, and **SG Srinivasa** (2018) 2D LDPC Codes and Joint Detection and Decoding for Two-Dimensional Magnetic Recording. *IEEE. Trans. Magn.* 54 (2): 3100111

9. Chandraramabhadra Murthy (ECE)

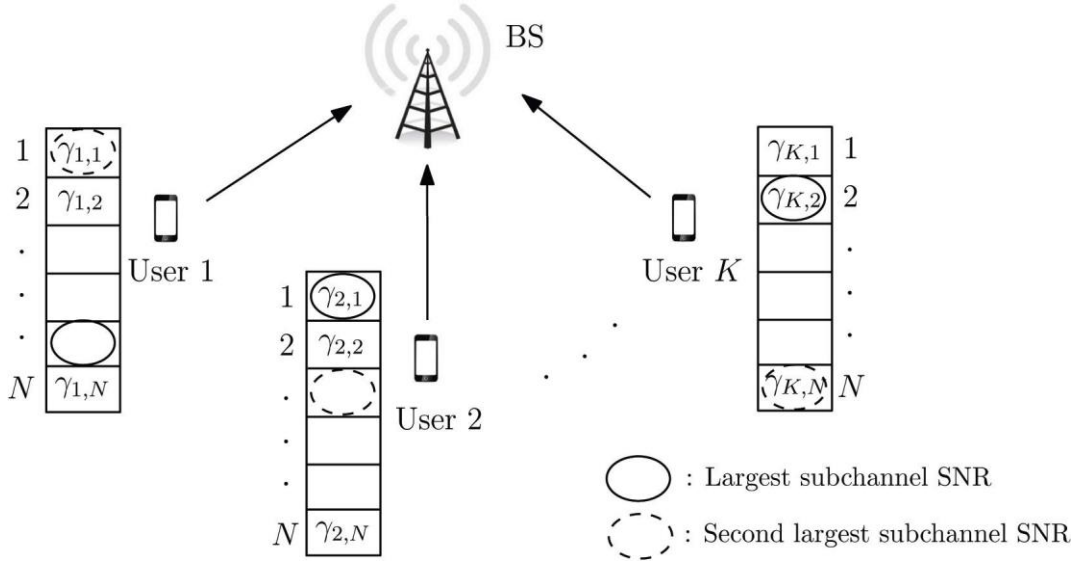




The study proposes an algorithm for recovering jointly sparse vectors from noisy underdetermined linear measurements. Left: it can recover supports of size larger than the number of measurements per vector (yellow: success, green: failure); Right: it is the fastest solver available.

Reference: S Khanna and **CR Murthy** (2017) Rényi Divergence Based Covariance Matching Pursuit of Joint Sparse Support. *Proceedings of IEEE 18th International Workshop on Signal Processing Advances in Wireless Communications, July 2017.*

10. Neelesh Mehta (ECE)



A new throughput-optimal policy developed for contemporary cellular wireless communication systems. It enables a base station to perform spectrally-efficient user scheduling and rate adaptation with very limited information about the channels it is transmitting on. The figure illustrates the best-m limited feedback scheme that is employed by the 4G Long Term Evolution (LTE) standard for which the policy was developed.

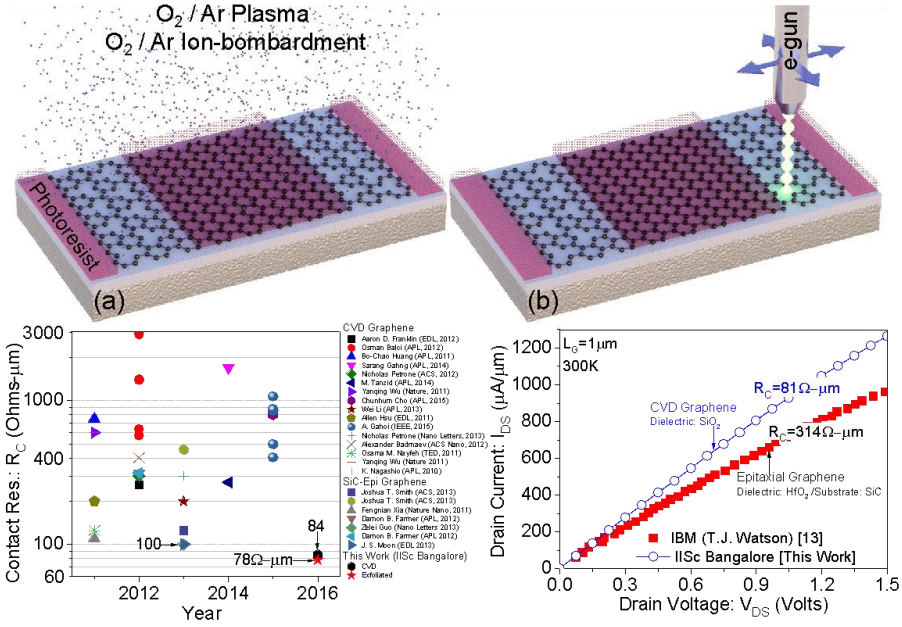
Reference: J Francis and **NB Mehta** (2017) Throughput-Optimal Scheduling and Rate Adaptation for Reduced Feedback Best-M Scheme in OFDM Systems*. IEEE Trans. Communications*, 65 (7):3053–3065.

11. Prasanta Kumar Ghosh (EE)

Electromagnetic articulograph (EMA) uses sensors to measure the motion of speech articulators namely, tongue, jaw, lips in synchrony with the microphone-based speech recording. Placement of EMA sensors (shown in close-view) is critical for recording good quality speech articulation, which, in turn, helps in providing articulatory feedback in several applications including pronunciation evaluation and clinical applications related to speaking disorders.

Reference: PA Kumar, A Illa, A Afshan and **PK Ghosh** (2018) Optimal sensor placement in electromagnetic articulography recording for speech production study. *Computer Speech & Language* 47(2018): 157-174.

12. Mayank Shrivastava (DESE)



In a significant breakthrough in our in our understanding of the quantum nature of graphene's interface with outside world, the authors of the paper studied how the overlap of atomic orbitals between carbon and metal atoms affects the graphene-metal interface. The study has enabled them to invent novel techniques to engineer graphene contact that has the lowest recorded resistance to the external world. Their discovery and subsequent invention, while breaking several records – including the one from IBM's research centre in T. J. Watson, USA – has helped achieve the highest transistor performance. This work was showcased at International Electron Device Meeting (IEDM, Dec. 2016), the world's most competitive platform in the field of electron devices, which mostly showcases technology and fundamental breakthroughs in the field.

References:

1. A Meersha, HB Variar, K Bharadwaj, A Mishra, S Raghavan, N Bhat and **M Shrivastava** (2016) Record Low Metal – (CVD) Graphene Contact Resistance Using Atomic Orbital Overlap Engineering. *Proceedings of IEEE International Electron Device Meeting, December, USA, 2016.*
2. A Mishra, A Meersha, S Raghavan and **M Shrivastava** (2018) Observing Non-equilibrium State of Transport through Graphene Channel at the Nano-Second Time Scale. *Applied Physics Letters*, 111 (26): 263101-6. DOI: 10.1063/1.5006258.