IEEE Brainwaves

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IEEE Brainwaves Feature Events :

Parallel Computing Workshop by GPU Center of Excellence IITB

A workshop on parallel computing with GPU was organized by a team from Indian Institute of Technology Bombay (IITB). IITB was awarded the NVIDIA GPU CENTRE (GCOE) in the year 2013. GCOE plays a major role in promoting and supporting GPU computing by supporting HPC infrastructure development, student internships and research publications. The workshop aimed at introducing some of the key tools for parallel scientific computing and embedded computing. The workshop was included with lecture cum demo sessions and hands-on session.

The workshop was divided into three sessions:

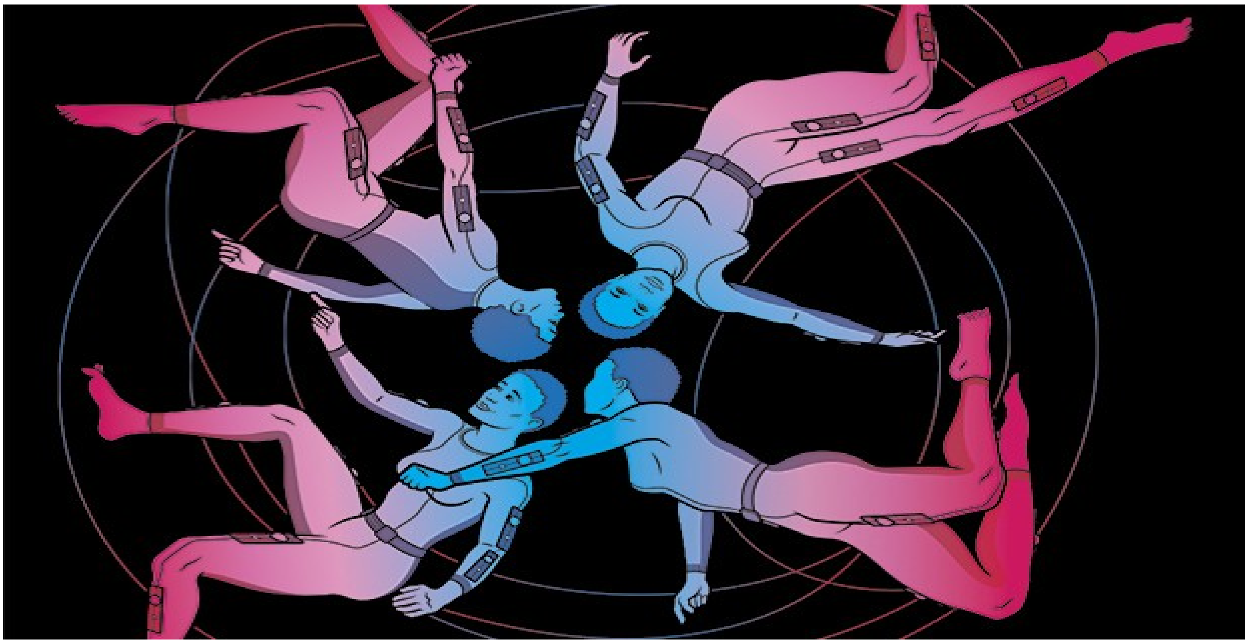
1. Parallel computing with MATLAB
2. GPU computing with CUDA
3. Embedded Super Computing with Jetson TK1 board

Prof. S. V. Natraj interacted with the attendees of the seminar and gave them a brief idea on parallel computing. GPU computing with CUDA: This part focused on enabling users to write CUDA codes, which was followed by an introduction to OpenACC – a standard for parallelizing existing serial code. Then the participants were introduced to the concept of GPU using single-block and multi-block vector additions. The session further continued with examples of shared memory, device query and error handling demos and hands-on. Parallel computing with MATLAB: This session aimed on reducing the computing time taken by MATLAB. The concept of vectorization, parallel MATLAB computing on multiple CPU cores, and parallel MATLAB computing on GPUs were explained in detail. The participants were taught how to parallelize loops, distribute large arrays over multiple CPUs, and speed up the matrix computations on both CPUs and GPUs. The concept was demonstrated through hands-on sessions. Embedded Super Computing with Jetson TK1 board: This part covered features and applications of embedded supercomputing with NVIDIA's high end Embedded platform Jetson TK-1. Jetson TK-1 gives high-performance with low-energy consumption for deep learning and computer vision applications. The participants were introduced to hardware and software development on the Jetson TK-1 platform, enabling them to explore platform in their research work.

IEEE Spectrum Article :

Tomorrow's Space Suit: Personal "Gravity Pack" Comes Standard

Compact gyroscopes could help astronauts live and work in space



After exiting the air lock, an astronaut uses the thrusters on her space suit to propel herself toward a nearby asteroid. With great care, she gets as close and as steady as she can in preparation for knocking a few samples off the surface. But with very little gravity to anchor her, the strike of her hammer throws her backward in an uncontrolled tumble. This scenario may sound a bit comic, but it's one that engineers will have to keep in mind as they design ways to once again send astronauts out beyond low earth orbit—to a piece of an asteroid brought close to the moon by a robotic spacecraft, according to NASA's current plans; to other small bodies in deep space; and on long missions to what could be our generation's ultimate destination—Mars.

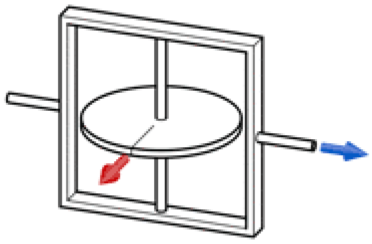


Illustration 1: A control moment gyroscope, such as the single-gimbal variety here, uses the angular momentum of a spinning mass [center] to create torque. Rotating the spin axis of this mass using a gimbal [blue arrow] generates a torque in the direction of the red arrow. A body attached to the CMG will rotate around this red axis (clockwise from this perspective).

Of the myriad dangers and difficulties associated with space travel, weightlessness places some of the biggest demands on an astronaut's body. The absence of gravity can wreak havoc on an astronaut's physiology, causing muscles to atrophy, weakening bones, and producing disorientation and unsteadiness that can persist even after the return home.

The lack of gravity also turns each space walk into a precise dance. Even the slightest nudge against a surface will push an astronaut off in the opposite direction. This challenge will only become greater once people start exploring environments where they don't have the benefit of handholds and robotic arms, which astronauts now use to move around the exterior of the International Space Station (ISS).

Fortunately, there is a technology that could help address these sorts of difficulties: the control moment gyroscope, or CMG. Unlike the sensor-type gyroscopes found in smartphones and other gadgets, the CMG is an actuation device. It uses a spinning mass to rotate an object or resist such movement, in the same way that changing the rotation axis of a spinning bicycle wheel while you're seated in a chair can cause you to turn.

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