Origami Metamaterials

For Prelims: Origami Metamaterials, Metamaterials and its properties

For Mains: Achievements of Indians in Science & Technology

Why in News?

Researchers from **Indian Institute of Technology Madras** have developed such a material, called Origami metamaterials which could have many uses.

- These combine the **Japanese art of paper folding (origami)** and the existing material of choice and fold it to obtain desired properties.

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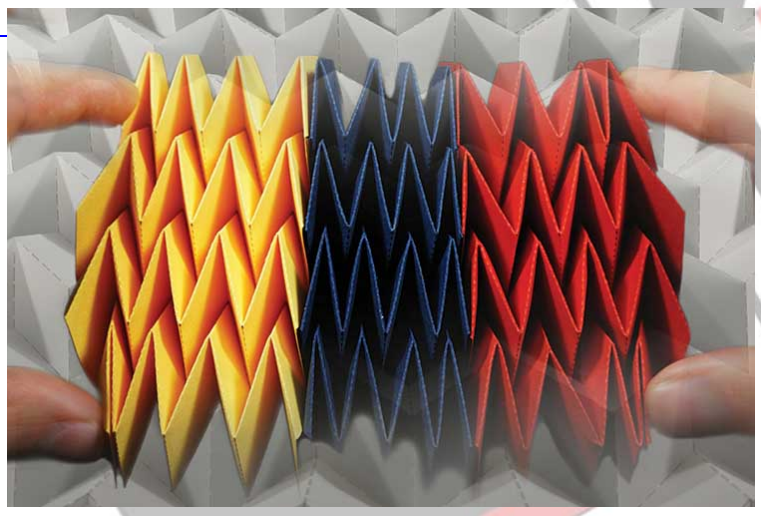

What are the Origami Metamaterials?

- Researchers have developed a **special class of origami metamaterials** which show a constant value of **Poisson Ratio** when subjected to stress.
    - When a **material is crushed or stretched along a particular direction**, it undergoes a modification in the perpendicular, or lateral, direction.
    - The **ratio between the deformation along the force and the deformation in a direction lateral** to the force is called the Poisson ratio. The Poisson ratio **can be positive or negative.**
    - In order to be useful, **materials need to maintain a constant Poisson ratio** when they crumble under pressure. However, they are prone not to do so, and the Poisson ratio varies as they deform.
- The benefit is that the **observed property does not depend** on whether it is made from a **sheet of paper, polymer or metal** but under impact the sheet folds up along the creases.

What are Metamaterials?

- Metamaterials are **smart materials that have a wide range of properties** and can be so different from each other that there isn't a definition for them, although what they all have in common is that they are from an artificial origin.
- This means that **they aren't found in nature** and have been created by people.

What are the Properties of the Metamaterials?

- Apart from their artificial origin, metamaterials are characterized because they have **unusual electromagnetic properties**, coming from their structure and arrangement and not from their composition.
- This is similar to what happens with **graphite, diamond and** graphene**,** since they are all made of carbon, but due to their structure, they have very different properties.
- One of the properties that can vary the metamaterials can be, for example, that the **material has a negative refractive index.**
    - This makes **these materials of great importance in optics** and electromagnetism applications.

What are the Potential Applications of Metamaterials?

- Potential Applications of Metamaterials include **optical filtering, medical devices, remote aerospace operations**, sensor detectors, solar power management, crowd control, radomes, antenna lenses, and even **earthquake** protection.
- **Lenses made of metamaterials** may even enable imaging below the diffraction limit that prevents conventional optical lenses from magnifying any further.

Source: TH