

4C, EAP braided biaxial structure **400** has a curled structure because selected groups of EAP segments are activated. Specifically, groups of EAP segments along curve **482** are activated with a first polarity and groups of EAP segments along curve **484** are activated with a polarity opposite the first polarity. FIG. **4D** is a side view of one embodiment of an EAP structure depicting a double-curved deformation. As shown in FIG. **4D**, EAP braided biaxial structure **400** has a double-curved structure because selected groups of EAP segments are activated differentially. Specifically, groups of EAP segments along curve **492** and curve **498** are activated in similar fashion to curve **482** of FIG. **4C** and groups of EAP segments along curve **494** and curve **496** are activated in similar fashion to curve **484** of FIG. **4C**.

FIG. **5** is a flowchart illustrating exemplary process steps taken to implement an exemplary EAP structure. Certain details and features have been left out of flowchart **500** of FIG. **5** that are apparent to a person of ordinary skill in the art. For example, a step may consist of one or more sub-steps or may involve specialized equipment or materials, as known in the art. While STEPS **510** through **560** shown in flowchart **500** are sufficient to describe one embodiment of the EAP structure, other embodiments of the EAP structure may utilize steps different from those shown in flowchart **500**.

Referring to FIG. **5**, at STEP **510** in flowchart **500**, the method forms a plurality of EAP segments. In one embodiment, EAP segments have a tile configuration, where depth is less than width or length. After STEP **510**, the method proceeds to STEP **520**. At STEP **520** in flowchart **500**, the method electrically isolates each EAP segment of the plurality of EAP segments formed in STEP **510**. In one embodiment, the method uses insulators such as plastic to electrically isolate each EAP segment. After STEP **520**, the method proceeds to STEP **530**. At STEP **530** in flowchart **500**, the method operatively couples EAP segments in a concatenated configuration to form a plurality of EAP strands. After STEP **530**, the method proceeds to STEP **540**.

At STEP **540** in flowchart **500**, the method configures the plurality of EAP strands into an EAP structure. In one embodiment, the method configures the plurality of EAP strands into an EAP braided structure. In one embodiment, the method configures the plurality of EAP strands into an EAP biaxial braided structure. In one embodiment, the method configures the plurality of EAP strands into an EAP biaxial braided snake. In one embodiment, the method configures the plurality of EAP strands into an EAP braided sphere. In one embodiment, the method configures the plurality of EAP strands into an EAP braided disc. In one embodiment, the method configures the plurality of EAP strands into an EAP braided artificial muscle. In one embodiment, the method configures the plurality of EAP strands into an EAP braided regulator (e.g., artificial sphincter). In one embodiment, the method configures the plurality of EAP strands into an EAP braided peristaltic pump (e.g., artificial heart or colon). In one embodiment, the method configures the plurality of EAP strands into an EAP braided locally controllable bladder. After STEP **540**, the method proceeds to STEP **550**. At STEP **550** in flowchart **500**, the method operatively couples each EAP segment of the plurality of EAP segments to an associated activator of a plurality of activators. In one embodiment, the plurality of activators comprises electrode pairs (e.g., first electrode and second electrode). In one embodiment, STEP **550** further includes a sub-step of operatively coupling the plurality of activators to a controller such as a computer to provide global and local activation of EAP segments. After STEP **550**, the method

proceeds to STEP **560**. At STEP **560** in flowchart **500**, the method selectively activates EAP segments to produce a desired deformation or motion. Those skilled in the art shall recognize that the order of some of the STEPS of the method in flowchart **500** can be changed without departing from the scope or spirit of the EAP structure. For example, STEP **550** can be performed subsequent to STEP **510** and prior to STEP **520**.

From the above description, it is manifest that various techniques can be used for implementing the concepts without departing from their scope. Moreover, a person of ordinary skill in the art would recognize that changes can be made in form and detail without departing from the spirit and the scope. The described embodiments are to be considered in all respects as illustrative and not restrictive. It should also be understood that the particular embodiments described herein are capable of many rearrangements, modifications, and substitutions without departing from the scope and spirit.

We claim:

**1.** An EAP Structure, comprising:

a) at least one EAP strand, wherein an EAP strand comprises:

i) a plurality of EAP segments, wherein an EAP segment comprises:

(1) an EAP tile having a length, a width and a depth, wherein said depth is less than said length and said width;

(2) an activator, operatively coupled to said EAP tile, capable of facilitating activation of said EAP tile;

ii) a plurality of insulators;

wherein, said plurality of EAP segments and said plurality of insulators have a concatenated configuration, wherein adjacent EAP segments are electrically separated by one of said plurality of insulators, and wherein said EAP segments are operatively coupled to said plurality of insulators.

**2.** The EAP structure of claim **1**, wherein said activator comprises a first electrode and a second electrode.

**3.** The EAP structure of claim **1**, wherein said EAP tile comprises a conductive polymer.

**4.** The EAP structure of claim **1**, wherein said EAP tile comprises a dielectric elastomer.

**5.** The EAP structure of claim **1**, wherein said EAP structure further comprises a controller, operatively coupled to a plurality of said activators, capable of selectively activating said EAP tiles individually or in groups.

**6.** The EAP structure of claim **1**, wherein said EAP structure comprises a plurality of EAP strands having a braided configuration.

**7.** The EAP structure of claim **1**, wherein said EAP structure comprises a plurality of EAP strands having a configuration selected from the group consisting of EAP biaxial braided snakes, EAP braided spheres, EAP braided discs, EAP braided artificial muscles, EAP braided regulators, EAP braided peristaltic pumps and EAP braided locally controllable bladders.

**8.** The EAP structure of claim **1**, wherein said EAP structure comprises a plurality of EAP strands having an EAP animal toy configuration comprising a plurality of discrete EAP structures, which can be activated independently or in conjunction.

**9.** The EAP structure of claim **6**, wherein said EAP structure further comprises a frame, operatively coupled to ends of said plurality of EAP strands.

**10.** The EAP structure of claim **1**, wherein said EAP structure comprises a plurality of EAP strands having a biaxial braided configuration.