[0021] Alternatively or in addition, the method further includes causing fluid to flow downstream from the pump outlet through a tortuous flow-impeding conduit. The conduit may have various forms. It may have at least two turns. It may be coiled. It may have a serpentine shape. Optionally, the conduit has a length and an internal diameter selected to provide a predetermined impedance based on at least one of a viscosity and a density of the fluid. Optionally the internal diameter of the conduit is sufficiently large so as to prevent occlusion due to flow of the fluid through the conduit.

[0022] In a further embodiment, the inlet line, the pumping chamber, the pump outlet and the force application assembly are enclosed inside a patch-sized housing, and actuating the force application assembly includes using a processor inside the housing to cause actuation of the force application assembly.

[0023] Optionally, the housing has a largest dimension, and the conduit has a length greater than the largest dimension.

[0024] In a further embodiment, actuating the force application assembly includes inducing using a shape memory actuator. Optionally, using a shape memory actuator includes using one of a plurality of electrical paths of different lengths through the shape-memory actuator, and each electrical path provides a different actuation force.

[0025] In a further embodiment, the force application assembly has a normal mode for normal operation in urging flow through the pump outlet and a priming mode for priming the pumping chamber. In this embodiment, using the shape memory actuator includes using a shorter electrical path of the shape-memory actuator during the normal mode of the force application assembly and using a longer electrical path of the shape-memory actuator during the priming mode of the force application assembly.

[0026] In a further embodiment, the force application assembly operates in at least a basal mode and a bolus mode. When in the basal mode, the pumping chamber outputs fluid at a basal rate. When in the bolus mode, the pumping chamber outputs fluid at a bolus rate that is greater than the basal rate. A shorter shape-memory actuator is used during the basal mode of the force application assembly and a longer shape-memory actuator is used during the bolus mode of the force application assembly.

[0027] In a further embodiment, actuating the force application assembly includes inducing using a plurality of shape memory actuators. Optionally, using a plurality of shape memory actuators includes using them to provide for redundant operation. Optionally, using a plurality of shape memory actuators includes using different numbers of shape-memory actuators to provide different actuation forces, stroke lengths or both. Optionally, using a plurality of shape memory actuators includes using shape-memory actuators of at least two different lengths.

[0028] In a further embodiment, the force application assembly has a normal mode for normal operation in urging flow through the pump outlet and a priming mode for priming the pumping chamber. In this embodiment, using a plurality of shape memory actuators includes using a shorter shape-memory actuator during the normal mode of the force application assembly and using longer shape-memory actuator during the priming mode of the force application assembly.

[0029] Optionally, using a plurality of shape memory actuators includes using shape-memory actuators of at least two different gauges.

[0030] In another embodiment, the invention provides a system for pumping fluid through a line. In this embodiment, the system includes a pumping chamber having an inlet connectable to provide fluid communication with a fluid source, and a pump outlet. The system also includes a force application assembly adapted to provide a compressive stroke to the pumping chamber. In this embodiment, the compressive stroke causes a restriction of retrograde flow of fluid from the pumping chamber through the inlet while urging fluid from the pumping chamber to the pump outlet.

[0031] Optionally, the force application assembly is coupled to an inlet valve actuator and to a pump actuator, so that the compressive stroke actuates an inlet valve coupled between the inlet and the fluid source to close the valve when the pump actuator causes fluid to be urged from the pumping chamber to the pump outlet.

[0032] Optionally, the force application assembly includes a plate coupled to the valve actuator, to the pump actuator, and to a motor for coordinated operation of the valve actuator and the pump actuator. Optionally, the motor includes a shape-memory actuator. Also optionally, the motor includes at least one pulley for folding the shape-memory actuator to fit within the reusable portion. Optionally, the force application assembly includes a motor.

[0033] In a further related embodiment, the motor includes a shape-memory actuator. Optionally, the shape-memory actuator is electrically coupled so as to provide a plurality of electrical paths of different lengths through the shape-memory actuator, each electrical path providing a different actuation force. Optionally, the force application assembly has a normal mode for operating the pumping chamber under normal pumping conditions and a priming mode for priming the pumping chamber; in this circumstance a shorter electrical path of the shape-memory actuator is used during the normal mode of the force application assembly and a longer electrical path is used during the priming mode of the force application assembly.

[0034] In another related embodiment, the motor includes a plurality of shape-memory actuators. Optionally, the plurality of shape-memory actuators provide for redundant operation of the force application assembly. Optionally, different numbers of shape-memory actuators are used to provide different actuation forces, stroke lengths or both. Optionally, the plurality of shape-memory actuators includes shape-memory actuators of at least two different lengths. Optionally, the force application assembly has a normal mode for operating the pumping chamber under normal pumping conditions and a priming mode for priming the pumping chamber; in this circumstance, a shorter shape-memory actuator is used during the normal mode of the force application assembly and a longer shape-memory actuator is used during the priming mode of the force application assembly.

[0035] In a further related embodiment, the plurality of shape-memory actuators includes shape-memory actuators of at least two different gauges.

[0036] A yet further related embodiment additionally includes a downstream dispensing assembly in series with the pump outlet. In this embodiment, the dispensing assembly includes a resilient dispensing chamber. Optionally, the embodiment further includes a sensor for measuring a