CLAIMS

What is claimed is:

1. A sensor for detecting material deposits in a fluid flow conduit, the sensor comprising:

a body; and

an array of pairs of temperature sensors disposed within the body, each pair of temperature sensors spaced a distance apart along a primary flow direction of the fluid flow conduit; and

wherein the array of pairs of temperature sensors are arranged in multiple rows and columns.

2. The sensor according to Claim 1 further comprising a heater secured to an exterior portion of the body.

3. The sensor according to Claim 2 further comprising an insulation member disposed over the heater.

4. The sensor according to Claim 2, wherein the heater defines a geometry matching a geometry of the exterior portion of the body.

5. The sensor according to Claim 1, wherein the body defines an interior portion with a geometric profile matching an exterior geometry of the conduit.

6. The sensor according to Claim 1, wherein the body is a material selected from the group consisting of Aluminum Nitride (AlN) and Boron Nitride.

7. The sensor according to Claim 1, wherein the temperature sensors are selected from the group consisting of thermocouples, RTDs, thermistors, and an integrated circuit temperature transducer.

8. The sensor according to Claim 1, wherein the body defines a plurality of interior apertures, and a temperature sensor of each of the pairs of temperature sensors is disposed within an interior aperture of the plurality of interior apertures.

9. The sensor according to Claim 8, wherein at least a portion of the plurality of interior apertures is disposed at an interior portion of the body.

10. The sensor according to Claim 8, wherein the interior apertures extend longitudinally, along the primary flow direction.

11. The sensor according to Claim 8, wherein the interior apertures extend transversely, normal to the primary flow direction.

12. The sensor according to Claim 11, wherein at least some of the temperature sensors are spring-loaded within the interior apertures.

13. The sensor according to Claim 1 further comprising a heat sink secured to an exterior portion of the body.

14. The sensor according to Claim 1 further comprising a mounting device adapted to secure the body to the conduit.

15. The sensor according to Claim 14, wherein the mounting device is one of a bracket assembly and a band clamp assembly.

16. A system for detecting material deposits in a fluid flow conduit, the system comprising:

the sensor according to Claim 1;

a mounting means for securing the sensor to the fluid flow conduit;

a computing device configured to determine temperatures from the array of pairs of temperature sensors, monitor differences in thermal response of the array of pairs of temperature sensors over time, and determine a presence of material deposits based on the differences in thermal response; and

a clog indication means.

17. The system according to Claim 16 further comprising:

a heater disposed proximate the sensor; and

a controller in communication with the heater,

wherein the controller activates the heater to generate auxiliary heat for active detection of the material deposits.

18. The system according to Claim 16, wherein the computing device is configured to provide pulsed power to the array of pairs of temperature sensors, thereby generating heat for active detection of the material deposits.

19. A method of detecting material deposits in a fluid flow conduit, the method comprising:

detecting a first temperature at a first location along the fluid flow conduit;

detecting a second temperature at a second location along the fluid flow conduit, the second location being spaced a distance apart longitudinally from the first location;

monitoring a temperature differential between the first temperature and the second temperature over time; and

determining a presence of material deposits based on the temperature differential,

wherein the first temperature is detected with a first temperature sensor, and the second temperature is detected with a second temperature sensor; and

wherein the first temperature sensor and the second temperature form a pair of temperature sensors in an array of pairs of temperature sensors arranged in multiple rows and columns.

21. The sensor according to Claim 1, wherein the rows of the array of pairs of temperature sensors are stacked in a radial direction of the fluid flow conduit.

22. The method according to Claim 20, wherein the rows of the array of pairs of temperature sensors are stacked in a radial direction of the fluid flow conduit