WHAT IS CLAIMED IS:

1. A device under test (DUT) cooling system comprising:

a refrigerant line and a fluid line extending through a plurality of heat exchangers of the cooling system, the heat exchangers arranged successively and configured to transfer heat between a refrigerant mixture in the refrigerant line and a fluid in the fluid line;

a digital scroll compressor having: an intake for providing the refrigerant mixture to the digital scroll compressor; a discharge connecting to the refrigerant line to provide the refrigerant mixture to the heat exchangers; a plurality of scroll elements between the intake and the discharge for compressing the refrigerant mixture; and a valve configured to separate the scroll elements when in an open position to allow refrigerant to flow freely between the intake and the discharge, the scroll elements compressing the refrigerant when the valve is in the closed position;

a plurality of sensors configured to measure a plurality of variables; and

a controller configured to: determine a set duty cycle based on a target fluid temperature and the variables; switch the valve between an open and closed position based on the set duty cycle; and determine a new set duty cycle, after a set time period has passed, based on the target fluid temperature and the variables,

wherein the set duty cycle is modified to cool the fluid to below the target fluid temperature within the heat exchangers, the system further comprising a heater thermally coupled to the fluid line downstream of the heat exchangers and configured to heat fluid within the fluid line to the target temperature.

2. The system of Claim 1, wherein the variables include an output temperature of fluid exiting the system, a fluid input temperature, and a fluid flow rate.

3. The system of Claim 1, wherein the digital scroll compressor further comprises a motor oscillating the scroll elements with respect to one another at a uniform rate.

4. The system of Claim 1, wherein the set duty cycle includes an unload time limit of 90%.

5. The system of Claim 1, wherein the set duty cycle can repeat after at least 10 seconds have passed.

6. The system of Claim 1, wherein the set duty cycle is modified to cool the fluid to between 3 and 7 degrees Celsius below the target fluid temperature.

7. The system of Claim 1, wherein:

the intake of the digital scroll compressor receives the refrigerant mixture from a low pressure side of the refrigerant line;

the discharge of the digital scroll compressor discharges refrigerant to a condenser, which in turn discharges to a high pressure side of the refrigerant line;

at the intake of the digital scroll compressor, the refrigerant mixture comprises: a first refrigerant having a first boiling point; a second refrigerant having a second boiling point; and a third refrigerant having a third boiling point, the first boiling point being greater than the second boiling point and the second boiling point being greater than the third boiling point; and

the system further comprises a plurality of separators, each separator connected to the refrigerant line between two of the plurality of heat exchangers to separate a first mixture from a second mixture, the first mixture being substantially gas and the second mixture being substantially liquid, the first mixture being provided to the high pressure side and the second mixture being provided to an expander before being provided to the low pressure side.

8. The system of Claim 7, wherein:

a first separator of the plurality of the separators is connected to the high pressure

refrigerant line between a first heat exchanger of the plurality of heat exchangers and a second heat exchanger of the plurality of heat exchangers, the first separator configured to separate a liquid mixture comprising the first and second refrigerant from a gaseous mixture comprising the second and third refrigerants;

the liquid mixture is provided from the first separator to an expander before being provided to the low pressure side of the refrigerant line within the second heat exchanger; and

the gaseous mixture is provided to the high pressure side of the refrigerant line within the second heat exchanger.

9. A method of operating a device under test (DUT) cooling system comprising:

providing a refrigerant line and a fluid line extending through a plurality of heat exchangers, the heat exchangers arranged successively and configured to transfer heat between a refrigerant mixture in the refrigerant line and a fluid in the fluid line;

providing a digital scroll compressor having: an intake for providing the refrigerant mixture to the digital scroll compressor; a discharge connecting to the refrigerant line to provide the refrigerant mixture to the heat exchangers; a plurality of scroll elements for compressing the refrigerant mixture between the intake and the discharge; and a valve configured to separate the scroll elements when in an open position to allow the refrigerant mixture to flow freely between the intake and discharge, the scroll elements compressing the refrigerant when the valve is in the closed position;

providing a plurality of sensors configured to measure a plurality of variables;

configuring a controller to: determine a set duty cycle based on the variables; switch the valve between the open position and the closed position based on the set duty cycle such that the fluid exits the system substantially at a target fluid temperature;

and after a set time period, determine a new duty cycle based on the target fluid temperature and the variables;

modifying the set duty cycle to cool the fluid to below the target fluid temperature within the heat exchangers; and

providing a heater and thermally coupling the heater to the fluid line downstream of the heat exchangers, the heater configured to heat fluid within the fluid line to substantially the target fluid temperature.

10. The method of Claim 9, wherein the variables include an output temperature of fluid exiting the system, a fluid input temperature, and a fluid flow rate.

11. The method of Claim 9, wherein the digital scroll compressor comprises a motor oscillating the scroll elements with respect to one another at a uniform rate.

12. The method of Claim 9, wherein the set duty cycle includes an unload time limit of 90%.

13. The method of Claim 9, wherein the set duty cycle repeats after at least 10 seconds have passed.

14. The method of Claim 9, further comprising modifying the duty cycle to cool the fluid to between 3 and 7 degrees Celsius below the target fluid temperature.

15. The method of Claim 9, further comprising:

connecting the discharge of the digital scroll compressor to a condenser which connects to a high pressure side of the refrigerant line;

connecting the intake of the digital scroll compressor to a low pressure side of the refrigerant line;

providing a refrigerant mixture at the intake of the digital scroll compressor comprising: a first refrigerant having a first boiling point; a second refrigerant having a second boiling point;

and a third refrigerant having a third boiling point, the first boiling point being greater than the second boiling point and the second boiling point being greater than the third boiling point; and

providing a plurality of separators, each separator connected to the refrigerant line between two of the plurality of heat exchangers to separate a first mixture from a second mixture, the first mixture being substantially gas and the second mixture being substantially liquid, the first mixture being provided to the high pressure side and the second mixture being provided to an expander before being provided to the low pressure side.

16. The method of Claim 15, wherein:

a first separator of the plurality of the separators is connected to the high pressure refrigerant line between a first heat exchanger of the plurality of heat exchangers and a second heat exchanger of the plurality of heat exchangers, the first separator configured to separate a liquid mixture comprising the first and second refrigerant from a gaseous mixture comprising the second and third refrigerants;

providing the liquid mixture from the first separator to an expander before being provided to the low pressure side of the refrigerant line within the second heat exchanger; and

the gaseous mixture is provided to the high pressure side of the refrigerant line within the second heat exchanger.