We claim:

1. A method for determining vascular performance of a patient, the method comprising:

positioning a pump within a heart, the pump being configured to operate at an adjustable pump speed;

pumping the pump at a first pump speed;

monitoring a hemodynamic parameter during pumping at the first pump speed;

identifying a first phase of a first heartbeat of the heart over a first period of time;

predicting a second phase of a second heartbeat of the heart over a second period of time based on the monitored hemodynamic parameter;

changing the pump speed to a second pump speed during the second phase of the second heartbeat;

monitoring the hemodynamic parameter during the second phase;

comparing the monitored hemodynamic parameter during the first phase to the monitored hemodynamic parameter during the second phase to calculate a change in the hemodynamic parameter between the first phase and the second phase; and

computing, based on the change in the hemodynamic parameter between the first phase and the second phase, a metric indicative of vascular performance.

2. The method of claim 1, further comprising changing the second pump speed to the first pump speed after the second phase.

3. The method of claim 2, wherein the hemodynamic parameter is aortic pressure.

4 . The method of claim 3, wherein the first phase is one of a systolic period and a diastolic period, and the second phase is one of a systolic period and a diastolic period.

5. The method of claim 4, wherein the first phase is a first diastolic period and the second phase is a second diastolic period.

6. The method of claim 4, wherein the first phase is a first systolic period and the second phase is a second systolic period.

7. The method of claim 1, wherein identifying the first phase of the first heartbeat is based on variation in the monitored hemodynamic parameter over time while pumping at the first pump speed.

8. The method of any of claim 7, wherein predicting the second phase of the second heartbeat of the heart is based on the identified first phase of the heartbeat cycle.

9. The method of any of claim 1, wherein comparing the hemodynamic parameter during the first phase to the second phase comprises:

calculating a first blood volume pumped by the heart during the first phase;

calculating a second blood volume pumped by the heart during the second phase; and

determining a numerical difference between the first blood volume and the second blood volume.

10. The method of claim 8, the method further comprising assessing linearity of the change in the hemodynamic parameter between the first phase and the second phase over time.

11. The method of claim 10, wherein determining cardiac performance of the heart is determined by:

calculating, based on the change in the hemodynamic parameter between the first phase and the second phase, vascular compliance and vascular resistance of the systemic vasculature; and

calculating, using a Windkessel model, cardiac output of the heart.

12. The method of claim 11, wherein changing the first pump speed to a second pump speed comprises increasing the pump speed.

13. The method of any of the foregoing claims, wherein changing the first pump speed to a second pump speed comprises decreasing the pump speed.

14. A method for determining cardiac output of a patient's heart using a processor controlled intravascular device, comprising the steps of:

detecting a first aortic pressure wave of the heart reflecting a plurality of beats of the heart, each reflected beat including a dicrotic notch;

applying hemodynamic support to the heart at a first pumping rate during a first beat of the plurality of beats;

adjusting the hemodynamic support to the heart during a second beat of the plurality of beats by providing a second pumping rate to the heart during the second beat after its dicrotic notch;

detecting a second aortic pressure wave of the heart during the second beat;

comparing, by the processor, the second aortic pressure wave to a portion of the first aortic pressure wave corresponding to the second beat to detect a change in the second aortic pressure wave and identify resistance and compliance of the vasculature; and

determining native cardiac output of the heart based on a non-linear transfer function programmed within the software, the transfer function relating cardiac output to vascular resistance and compliance.

15. The method of claim 14, wherein the non-linear transfer function includes a Windkessel model.

16. The method of claim 15, wherein hemodynamic support is provided by an intracardiac blood pump that has a cannula configured to be positioned across the aortic valve.

17. The method of claim 16 further comprising adjusting the hemodynamic support based on at least one of: the determined cardiac output, the resistance, or the compliance.

18. A method for determining native cardiac performance of a heart, the method comprising:

positioning a mechanical circulatory support device within a patient's vasculature and operating the device at a first output level during a first heartbeat, the device being operable to alter a hemodynamic parameter within the patient;

detecting a hemodynamic parameter during the first heartbeat;

operating the device so it outputs a second output level during a second heartbeat;

detecting the hemodynamic parameter during the second heartbeat;

comparing the hemodynamic parameter during the first heartbeat to the hemodynamic parameter during the second heartbeat to calculate a change in the hemodynamic parameter between the first heartbeat and the second heartbeat.

19. The method of 37, further comprising computing, based on the change in the hemodynamic parameter between the first heartbeat and the second heartbeat, a metric indicative of native cardiac performance of the heart.

20. The method of claim 38, wherein the mechanical circulatory support device comprises an intracardiac blood pump having a cannula that is configured to extend within the left ventricle of a heart.

21. The method of claim 39, wherein the hemodynamic parameter is aortic pressure, and wherein the mechanical circulatory support device comprises a pressure sensor configured to detect aortic pressure.

22. The method of claim 37, further comprising:

calculating, based on the change in the hemodynamic parameter between the first heartbeat and the second heartbeat, vascular compliance and vascular resistance of the heart; and

calculating native cardiac output of the heart.

23. The method of claims 41, further comprising:

comparing the monitored hemodynamic parameter during a first diastolic period of the first heartbeat to the monitored hemodynamic parameter during a second diastolic period of the second heartbeat to calculate a change in the hemodynamic parameter between the first diastolic period and the second diastolic period;

determining, based on the change in the hemodynamic parameter between the first diastolic period and the second diastolic period, resistance and compliance of the aorta; and

determining cardiac output based on a non-linear transfer function relating cardiac output to aortic resistance and compliance.