FOURIER SERIES

Property	Rating	Comment
Network output function:		
Continuous	Yes	
Smooth	Yes	Basis functions—sines and cosines—are infinitely differentiable.
Easily visualized	No	Result of summing sinusoids is generally difficult to visualize.
Generalizes beyond domain	No	Output function is periodic outside of domain. This is typically a poor approximation for outlying points.
Method for determining coefficients or weights:		
Inner product of target function and basis function	Yes	Basis function are complete and orthonormal. Realistically, this is the only appropriate training method for Fourier series.
Simultaneous equations for data points	Poor	Requires truncated series with as many terms as data points. Poor generalization to other points.
Gradient descent with all points on surface available for training.	Good	Over time, gradient descent approximates inner product, and orthonormality should pay off.
Gradient descent with finite number of points on surface available for training.	Poor	Poor generalization to other points.
Behavior at data points:		(Inner product training assumed.)
Reproduces data values exactly	Yes	If target function not periodic but series period equals domain size, then values on boundary not reproduced.
Suited to randomly scattered data versus regular grid	Poor	Behavior is unpredictable whenever the number of training points is finite.
Well-behaved between data points	No	Behavior between data points is quite unpredictable.
Expands for new data points	No	Adding points requires complete retraining.
Matches slope at finite number of data points	No	Matches slope everywhere if trained by inner products, but slopes may have any value if trained with finite number of data points.
Complexity:		
Difficulty of writing computer program	Medium	Numerical calculation of inner products for coefficients involves numerical integration.
Speed of coefficient calculation	Low	Numerical integration is rather slow.
Speed of function evaluation	Low	Every sine and cosine must be evaluated, and each sine or cosine calculation is time consuming.