

## ***Study of Relationship between River Meanders' Geometric Parameters and Sinuosity Factor***

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### ***ABSTRACT***

Running rivers in alluvial plains, always drawn to meandering process. In this paper, according to valley slope and river slope, the relationship between meanders' geometric parameters and sinuosity factor revealed. Based on the field data of Sistan River which is a meandering one, meanders geometric characteristics of this river were calculated and defined on the base of mathematical model.

Finally, estimated results were compared with observed measurements in different reaches of Sistan River. This research demonstrates that acquired estimations and field measurements have a good correlation coefficient.

### ***KEYWORDS***

River Meander, Sinuosity Factor, Sistan River

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(Lane, )

(Miller, ) (Leopold and Wolman, )

(Chitale, )

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(Leopold, Wolman and Miller, )

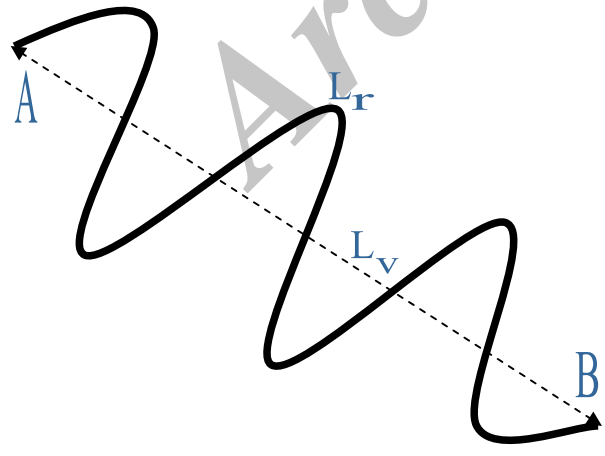
[]):

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$L_r$  ( )

) B A  $L_v$  (

)



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$$(P \geq \nu)$$

P

$L_r$

$$P = \frac{L_r}{L_v} \quad (1)$$

$(L_r > L_v)$   $L_v$

$$B \ A \quad (2)$$

( )  $(P > 1)$

$$S_r \ \Delta h$$

$(S_v > S_r)$

$$S_r = \frac{\Delta h}{L_r} \quad (3)$$

$$S_v = \frac{\Delta h}{L_v} \quad (4)$$

$$\frac{S_v}{S_r} = \frac{\frac{\Delta h}{L_v}}{\frac{\Delta h}{L_r}} = \frac{L_r}{L_v} \quad (5)$$

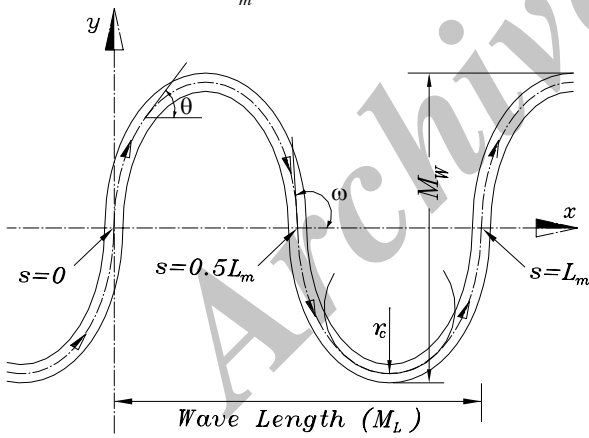
( ) (Langbein and Leopold, )

[ ] [ ] :

$$y = y_0 \sin kx, \quad k = \frac{\nu \pi}{M_L} \quad (6)$$

: ( )

$$\theta = \omega \sin ks, \quad k = \frac{\nu \pi}{L_m} \quad (7)$$



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x ( )

x y ( )

k  $M_w$  y  $y_0$

$\theta$   $M_L$

s  $\theta$   $\omega$  x

$L_m$

$$(1 < P < 1/\delta)$$

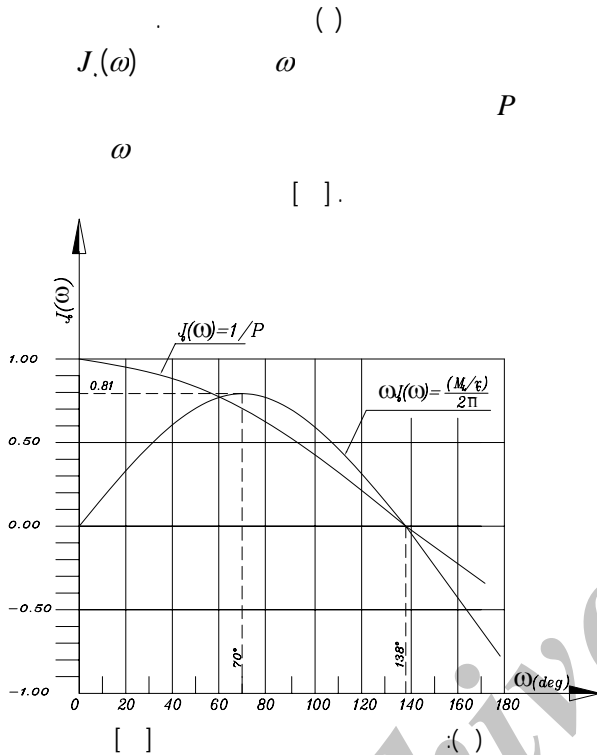
[ ] :

$$(1/\delta \leq P < \nu)$$

$$\xi = \frac{\theta}{\omega}$$

$$\frac{1}{P} = \frac{2}{\pi} \int_0^{\frac{\pi}{2}} \frac{\cos(\omega \xi)}{(\omega^2 - \xi^2)^{1/2}} d\xi \quad (1)$$

$$\frac{1}{P} = J_0(\omega) \quad (2)$$



$$P = \frac{L_m}{M_L} \quad (3)$$

$$d\left(\frac{x}{M_L}\right) = \frac{ds}{M_L} \cdot \cos\theta \quad (4)$$

$$s = \frac{1}{\pi} \cdot L_m \cdot \text{ArcSin} \frac{\theta}{\omega} \quad (5)$$

$$d\left(\frac{x}{M_L}\right) = \frac{-1}{\pi} \cdot \frac{L_m}{M_L} \cdot \frac{\cos\theta}{(\omega^2 - \theta^2)^{1/2}} d\theta \quad (6)$$

$$x = \frac{1}{\pi} M_L \quad (7)$$

$$\theta = \frac{x}{M_L} = \frac{1}{\pi} \quad (8)$$

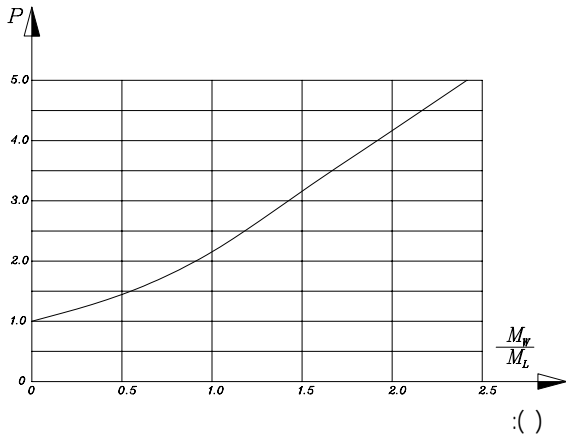
$$\int_0^{\frac{1}{\pi}} d\left(\frac{x}{M_L}\right) = \frac{-1}{\pi} \cdot \frac{L_m}{M_L} \cdot \int_0^{\frac{1}{\pi}} \frac{\cos\theta}{(\omega^2 - \theta^2)^{1/2}} d\theta$$

$$= \frac{1}{\pi} \cdot \frac{L_m}{M_L} \cdot \int_0^{\frac{1}{\pi}} \frac{\cos\theta}{(\omega^2 - \theta^2)^{1/2}} d\theta$$

$$= \frac{P}{\pi} \cdot \int_0^{\frac{1}{\pi}} \frac{\cos\theta}{(\omega^2 - \theta^2)^{1/2}} d\theta = \frac{1}{\pi}$$

$$\frac{1}{P} = \frac{2}{\pi} \int_0^{\frac{\pi}{2}} \frac{\cos\theta}{(\omega^2 - \theta^2)^{1/2}} d\theta \quad (9)$$





[ ]

(Rozovski, )

$$\left(\frac{M_w}{d} \geq \delta\right)$$

( )

[ ]:

$$d = \frac{\omega \cdot \kappa \cdot \sqrt{g} \cdot r_c}{\sqrt[3]{\delta C}}$$

( )

$\omega$

$C$  ( )

$r_c$

$g$  ( $\kappa \approx 0.1$ )

$d$

$\kappa$

$$r = \frac{d_s}{d_\theta} = \frac{\lambda}{d_s} = \frac{\lambda}{\sqrt{\pi\omega} \cdot L_m \cdot \cos\left(\frac{\sqrt{\pi}s}{L_m}\right)} \quad ( )$$

$$\frac{s}{L_m} = \cdot$$

( )

$$r_c = \frac{\lambda}{\sqrt{\pi\omega} L_m} = \frac{L_m}{\sqrt{\pi\omega}} \quad ( )$$

( )

$$r_c = \frac{P \cdot M_L}{\sqrt{\pi\omega}} = \frac{M_L}{\sqrt{\pi\omega} \cdot J_1(\omega)} \quad ( )$$

$r_c$  ( )

[ ]:

$$P = \frac{\sqrt{f\left(\frac{M_w}{M_L}\right)}}{\pi} \quad ( )$$

$$f\left(\frac{M_w}{M_L}\right) = \sqrt{1 + \left(\pi \frac{M_w}{M_L}\right)^2}$$

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$$\int_0^{\frac{\pi}{2}} \left[ \sqrt{1 - \frac{\left(\pi \frac{M_w}{M_L}\right)^2 \cdot \sin^2 \theta}{1 + \left(\frac{\pi M_w}{M_L}\right)^2}} \right] d\theta$$

$M_L$

$M_w$  ( )

$$P = \frac{L_m}{M_L} = \frac{\lambda}{J_1(\omega)} = \frac{\sqrt{\pi\omega} r_c}{M_L}$$

( )

$$\frac{\sqrt{f\left(\frac{M_w}{M_L}\right)}}{\pi} = \frac{\sqrt[3]{\delta d C}}{M_L \cdot \kappa \cdot \sqrt{g}}$$

( )

$\frac{M_w}{M_L}$

$P$

( )

( )

$$f\left(\frac{M_w}{M_L}\right) = \frac{\pi}{\sqrt{J_1(\omega)}} \quad ( )$$

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[[ ]

$P$	$S_v$	$S_r$	
/	/	/	
/	/	/	
/	/	/	
/	/	/	

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				$m$	$L_m$
				$m$	$M_L$
				$m$	$M_W$
				$m$	$r_c$
/	/	/		$rad$	$\theta / \pi$
/	/	/		$rad$	$\omega / \pi$
/	/	/	/	$m$	$d$
/	/	/	/		$S_v$
/	/	/	/		$S_r$
/	/	/			$P$

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$P = \backslash$

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( ) ( )

( $\omega$ )

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$$\frac{M_w}{M_L}$$

$$R^r = 0.18929$$

$$R^r = 0.96223$$

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) ( )  
(

( $\omega$ )

( $P$ )

( $r_c$ )

	( $L$ )		( $L$ )	:	$A$	
		( $L$ )	( $L$ )	:	$C$	
			( $L$ )	:	$d$	
			( $L$ )	:	$g$	
			( $L$ )	:	$k$	
			( $L$ )	:	$L_m$	
			( $L$ )	:	$L_r$	
			( $L$ )	:	$L_v$	
			( $L$ )	:	$M_L$	
			( $L$ )	:	$M_\omega$	
			(-)	:	$P$	
			( $L$ )	:	$r$	
			( $L$ )	:	$r_c$	
			( $L$ )	:	$s$	
			(-)	:	$S_r$	
			(-)	:	$S_v$	
			( $L$ )	:	$x$	
	( $L$ )	$x$		:	$Y$	
	( $L$ )		$Y$	:	$Y_0$	
			(-)	:	$\kappa$	
				:	$\theta$	
			(-)	:	$x$	
			(-)	:	$\theta$	
				:	$\frac{L_m}{M_L}$	

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/	/	/	/	/	/	1	$\frac{L_m}{M_L}$
/	/	/	/	/	/	~	$\frac{\omega}{\pi}$
/	/	/	/	/	/	~	$\frac{M_W}{M_L}$
/	/	/	/	/	/	~	$\frac{L_m}{r_c}$
/	/	/	/	/	/	~	$\frac{M_L}{r_c}$
/	/	/	/	/	/	-	$d$

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